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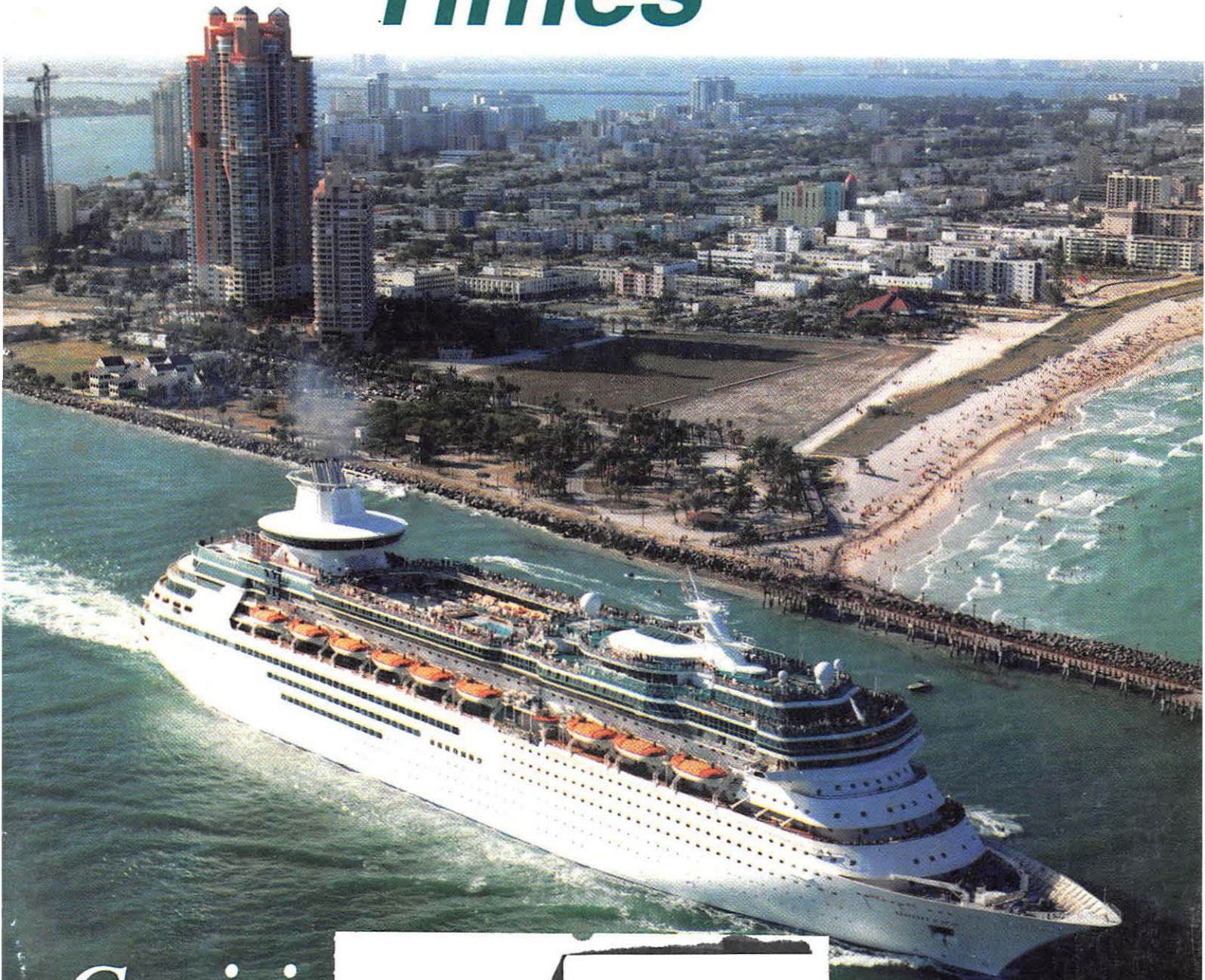
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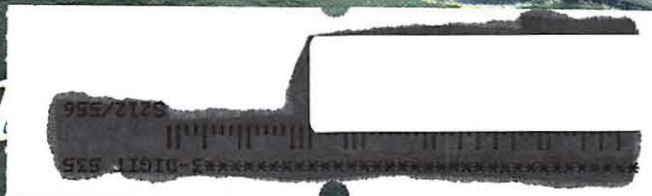


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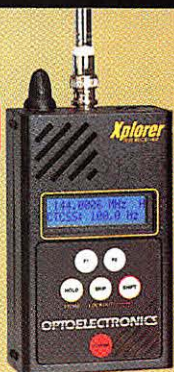
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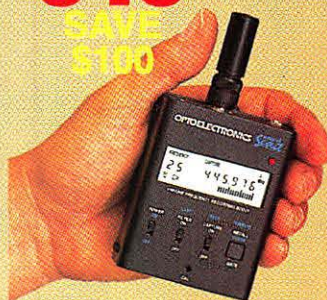
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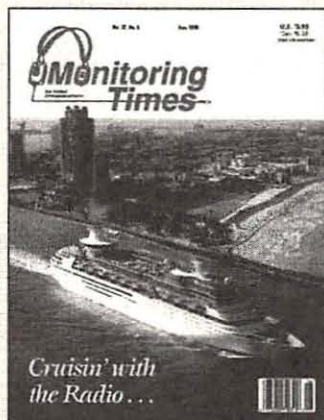
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## Cover Story

### DXing on the High Seas

By Philip Gebhardt

If you think a radio buff would be bored on a Caribbean cruise, think again! The possibilities are substantial on all bands from LF to VHF, but mediumwave reception is where our author found the most excitement to be.

Just imagine: you, too, could be spinning the dials to your heart's content. No voice nagging you about the lawn to be mowed, the garden to be weeded; just the cool sound of a marimba coming in from a station 500 miles away ... Turn to page 17 for details on what to do and what to expect.

Cover photo: The M/S *Majesty of the Seas* sails out of Miami. Photo by Ross Cobb, Aerials, Inc., <http://www.aerialsinc.com>

## C O N T E N T S

### Marine Monitoring on the Chesapeake ..... 8

By Ronald Perron

Chesapeake Bay is one of the busiest waterways on the East Coast; during the summer season it looks like you could cross the water just by walking across the boats. The guiding hand in managing traffic, containing pollution, coordinating rescue operations, and enforcing regulations in the upper part of the bay is the U.S. Coast Guard Activities Baltimore — a unique, coordinated effort which makes best use of area resources and agencies. The monitoring is terrific!

### On Board Canada's Billion Dollar Boat ..... 12

By Dave Holford

The *HMCS Ottawa* is the latest of Canada's Halifax class frigates and a marvel of modern electronics. The ship is festooned with antennae and radar from top to bottom. This antenna tour will open your eyes to the probable uses of many of the odd-shaped structures projecting from the modern-day warship.



### LORAN-C Navigation System ..... 20

By Albert Lozano

The LORAN system started out as an aid to aeronautical navigation, but today these low frequency signals serve primarily as an aid to marine navigation, plus some marginal use in civil aviation, land mobile, and military applications. Unless the deadline is extended, the system is slated for termination in the year 2000, so log it now! It's a great time to pick up a used LF receiver as boaters switch over to satellite-based navigation.

### Ham Radio: Safe Bet for Boaters ..... 24

By Arthur Lee

Whether you're on an ocean-going yacht or out on the lake, amateur radio can enhance the experience. It can save you time and frustration; it can make the hours fly by while you chat with new friends; or it could save a life. Think about it.

## REVIEWS:



Larry Magne wraps up the review of the Drake R8B, which he dubs the best in its price class (p.88). On page 86 Bob Parnass takes a look at the Opto DC442 decoder and compares it to earlier models by other manufacturers.

Optoelectronics has more up its sleeve, however. Turn to page 85 for an *MT* scoop — the *Optotrakker*! Based on the DC442 plus customized ScanStar software, this package can follow two types of trunking plus conventional channels, *simultaneously*!



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Highway 64 West,  
Brasstown, NC 28902-  
0098  
Telephone: (828) 837-9200  
Fax: (828) 837-2216 (24 hours)  
Internet Address: web: [www.grove-ent.com](http://www.grove-ent.com)  
or e-mail: [mt@grove.net](mailto:mt@grove.net)  
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#### Owners

Bob and Judy Grove

#### Publisher

Bob Grove, W8JHD  
[bgrove@grove.net](mailto:bgrove@grove.net)

#### Managing Editor

Rachel Baughn, KE4OPD  
[mteditor@grove.net](mailto:mteditor@grove.net)

#### Assistant Editor

Larry Van Horn, N5FPW

#### Art Director

John Bailey

#### Advertising Svcs.

Beth Leinbach  
(828) 389-4007  
[beth@grove.net](mailto:beth@grove.net)

#### Business Manager

Kelly Davis, KE4TAM  
[kelly@grove.net](mailto:kelly@grove.net)

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## EDITORIAL STAFF

Correspondence to columnists may be mailed c/o *Monitoring Times*; any request for a reply should include an SASE.

Frequency Manager .....	Gayle Van Horn .....	<a href="mailto:gayle@grove.net">gayle@grove.net</a>
Frequency Monitors .....	David Datko, Mark J. Fine .....	
Program Manager .....	Jim Frimmel .....	<a href="mailto:frimmel@startext.net">frimmel@startext.net</a>
American Bandscan .....	Doug Smith, W9WI .....	<a href="mailto:w9wi@bellsouth.net">w9wi@bellsouth.net</a>
And More! .....	Jack Elliott KB2GOM .....	<a href="mailto:lightkeeper@sprintmail.com">lightkeeper@sprintmail.com</a>
Antenna Topics .....	W. Clem Small, KR6A .....	<a href="mailto:clemsmal@bitterroot.net">clemsmal@bitterroot.net</a>
Beginner's Corner .....	T.J. Arey, WB2GHA .....	<a href="mailto:tjarey@mosquito.com">tjarey@mosquito.com</a>
Below 500 kHz .....	Kevin Carey, WB2QMY .....	<a href="mailto:lowband@gateway.net">lowband@gateway.net</a>
Computers and Radio .....	John Catalano .....	<a href="mailto:j_catalano@conknet.com">j_catalano@conknet.com</a>
Digital Digest .....	Bob Evans .....	<a href="mailto:revans@total.net">revans@total.net</a>
Experimenter's Wkshp .....	Bill Cheek .....	<a href="mailto:bcheek@san.rr.com">bcheek@san.rr.com</a>
Federal File .....	John Fulford, WA4VPY .....	<a href="mailto:JOHNFO413@aol.com">JOHNFO413@aol.com</a>
K.I.S. Radio .....	Richard Arland, K7SZ .....	<a href="mailto:k7sz@juno.net">k7sz@juno.net</a>
Magne Tests .....	Lawrence Magne .....	
On the Ham Bands .....	Ike Kerschner, N3IK .....	
Outer Limits .....	George Zeller .....	<a href="mailto:George.Zeller@acclink.com">George.Zeller@acclink.com</a>
PCS Front Line .....	Dan Veeneman .....	<a href="mailto:dan@decode.com">dan@decode.com</a>
Plane Talk .....	Jean Baker, KIN9DD .....	
Programming Spotlight .....	John Figliozzi, KC2BPU .....	<a href="mailto:johnfig@earthlink.net">johnfig@earthlink.net</a>
Propagation .....	Jacques d'Avignon .....	<a href="mailto:monitor@rac.ca">monitor@rac.ca</a>
QSL Corner .....	Gayle Van Horn .....	<a href="mailto:gayle@grove.net">gayle@grove.net</a>
Scanning Equipment .....	Bob Parnass, AJ9S .....	
Scanning Report .....	Richard Barnett .....	<a href="mailto:ScanMaster@aol.com">ScanMaster@aol.com</a>
SW Broadcasting .....	Glenn Hauser .....	<a href="mailto:ghauser@hotmail.com">ghauser@hotmail.com</a>
SW Broadcast Logs .....	Gayle Van Horn .....	<a href="mailto:gayle@grove.net">gayle@grove.net</a>
Utility World .....	Hugh Stegman, NV6H .....	<a href="mailto:driver8@netcom.com">driver8@netcom.com</a>
Washington Whispers .....	Fred Maia, W5YI .....	<a href="mailto:fmaia@internetMCI.com">fmaia@internetMCI.com</a>

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## FCC Makes Major Revisions to Equipment Authorization Process

**\* Forget the term "FCC Type Acceptance" of transmitters.** It will no longer be used! Transmitter manufacturers and importers will be glad to hear that the Commission has made major revisions to its equipment authorization process. The FCC will now permit electronic filing of equipment authorization applications.

And that is not all. The number of transmitters and other RF radiators requiring authorization is being drastically reduced by 49% ... from 3500 to 1800. The FCC said the new procedures will result in savings of at least \$100 million to manufacturers covered by the change.

There will only be three different authorization categories: Certification, where applications are sent to the FCC, and two manufacturer self-authorization programs, Declaration of Conformity, and Verification. The Notification program was eliminated and the Type Acceptance program was combined in the Certification program. Under the Certification program, third-party organizations other than the FCC will be permitted to certify products.

Commissioner Susan Ness issued a separate statement saying she "...strongly supported reducing unnecessary paper work and delays." She added, however, that agency resources freed up by liberalizing the new equipment authorization process should "...be redirected to enforcement activities, so that instances of harmful interference can be swiftly remedied."

The Commission said the new system could be in place as early as May. At first, the FCC will accept dual paper and electronically filed allocations to allow manufacturers time to become familiar with the new system. The requirement for (only) electronic equipment authorization filing goes into effect after one year. (ET Docket 97-94 adopted April 2, 1998)

The FCC also issued a Notice of Proposed Rulemaking seeking to require mandatory electronic filing of several broadcast applications and other forms. Many forms would be revised and shortened and some burdensome rules would be eliminated. (MM Docket 98-43 adopted April 2, 1998.)

**\* The FCC is in the process of remodeling their wireless radio licensing system.** In a proposal that ran to nearly 400 pages, the Commission says it will be consolidating, revising, and streamlining its license application procedures for all radio services licensed by the

FCC's Wireless Telecommunications Bureau (WTB).

The new integrated "single platform" Universal Licensing System (ULS) will replace 11 existing service-specific license databases. Plans are for ULS to become fully operational later this year. The FCC will also be replacing their more than 40 existing wireless application documents with only five: FCC Forms 601 through 605.

The single-page FCC Form 605 application and an accompanying "schedule" will be used as a short-form application for applicants who are not required to submit extensive technical data to receive a license — including applicants for the Amateur, Aviation, Business, Ship, Commercial and Personal Radio Service licenses.

For example: Amateur Service applicants would submit the Form 605 with a Schedule "C" attached. There are four other schedules: "A" is for the Ship Radio Service, "B" Aviation Radio Service, "D" Commercial Radio and "E" for GMRS. The FCC asked the public to comment on each of these forms and to offer any possible suggested modifications.

The FCC wants all ULS radio applications to be filed electronically "computer-to-computer" in the future and wants to know how the public feels about discontinuing manual filing of paper applications altogether.

A new wrinkle will require all applicants and licensees to submit their 9-digit Taxpayer Identification Number (TIN) to the FCC. For an individual, this is their Social Security Number (SSN). A business would use their Employer Identification Number (EIN.) The Debt Collection Improvement Act of 1996 requires government agencies to monitor and provide information about the public to the U.S. Treasury. This is to prevent refunding money to people and businesses who have an outstanding debt with the federal government.

**\* Not only did the FCC streamline licensing procedures, but they plan to deregulate many of the existing rules as well.** For example: The General Mobile Radio Service is a UHF land mobile radio service for short-distance two-way business and personal communications by licensees and their immediate family members.

Currently, GMRS applicants are authorized to use up to ten of the fifteen channels. The FCC is proposing to authorize GMRS stations to transmit on any of the fifteen channels from any

geographical location regulated by the FCC.

GMRS applicants are currently required to submit a very complicated application form which asks for technical and location information for control points and small base stations. The complex application procedure has served to keep the number of users low. The FCC said that, since all GMRS frequencies are shared and no frequency coordination is required, in the future they would only be asking for contact information, such as the applicant's name, address, and telephone number — a major deregulatory change indeed!

GMRS applicants will use the Form 605 and Schedule "E." Effective January 1, 1989, only individuals (and not business applicants) may now apply for a GMRS license. The bottom line is that the new GMRS rules will make it far easier for applicants to obtain a license.

**\* Internet taxes are coming, but when?** Congress is having trouble agreeing on when Internet taxation should start. The Clinton Administration had originally endorsed a plan to keep the Internet tax-free for six years.

The Internet Tax Freedom Act was to have prevented governments from collecting sales taxes on most purchases made over the Internet by treating electronic commerce the same as mail-order sales. Also barred would be taxes on Internet access. State governments oppose the Act as a violation of states' rights that will cost them needed tax revenue. They also believe the six year Internet tax ban is unfair to local stores which must collect sales taxes.

Now the National Governors' Association and other state and local officials are promoting a new three year plan. And the House is going along with it. They have now revised their bill to three years. The legislation bans taxes on Internet access and online services, bit and bandwidth taxes and any sales taxes on electronic commerce. President Clinton said he welcomed the compromise between state and congressional lawmakers.

The U.S. Senate, however, is not buying into the three year deal. Sen. Ron Wyden (D-Or) has countered with legislation offering a five year moratorium on state and local Internet taxation.

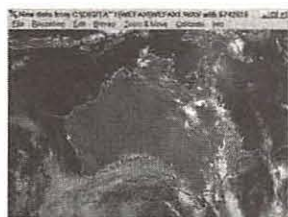
The Senate version would also impanel a congressional commission to study the entire issue of Internet taxation. There are more than 30,000 state and local taxing authorities and all, it seems, want a piece of the action!

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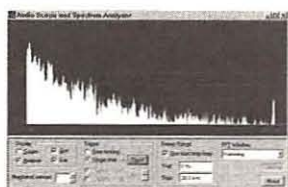
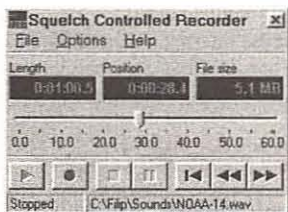
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## The Rest of the Story

In March, we left you hanging regarding the outcome of a distress call received on the very last day (Dec 31) that British coastal stations were monitoring 500 kHz for Morse code distress calls. Thanks to some investigative reporting by Pat Martindale, former auxiliary communications operator with HM Coastguard at MRSC (Marine Rescue Sub Centre) Humber, we now learn the rest of the story.

"The *MV Oak* was carrying a timber cargo, some of which was (as is usual) lashed to the deck. In heavy seas and hurricane force winds, this cargo got wet, which significantly altered the centre of gravity of the vessel resulting eventually in a 40 degree list. At this point engines and generators were lost.

"At the time that the ship sent its distress message in Morse on 500 kHz it also activated its EPIRB (an automatic emergency radio beacon), which was picked up by SRSAT (search and rescue satellite). Most of the communications then transferred to Inmarsat C, satellite Telex systems. RAF Nimrods were scrambled to shadow the vessel.

"At 19:30 hrs, the weather worsened.

"The nearest ship was 250 miles away (not 500 miles as reported in the article). The Coastguard were making valiant efforts to obtain help from other agencies to assist with the rescue of the crew...the USAF at RAF Mildenhall, the Royal Navy, and the Royal Air Force.

"A Chinook from RAF Odiham was hastily modified, fitted with long range tanks and a SAR winch and dispatched to Shannon, Ireland. On the way to Shannon the aircraft had to divert to RAF Chivenor to pick up a SAR trained winch crew. The Chinook got to Shannon, where it was refuelled and stood by on the ground.

"The crew of the *MV Oak* had also privately chartered the tug *Anglian Prince* to go out to her and assist with rescue / salvage operations... It was decided on scene that the *Anglian Prince* should escort the *MV Oak* and be available to render assistance as required. This she did, with the result that the *MV Oak* docked in Liverpool (her original destination port) two days later. Some of her cargo had been jettisoned, but all crew were safe and well despite their ordeal."

Pat wishes to thank Mr. Steve Varley, Operations Manager, HM Coastguard, Falmouth (duty officer during the incident) for filling us in on the conclusion of this dramatic story.

## More to this story?

In an Associated Press report, it was a small hand-held radio that rescued ten members of the *MV Vanessa* after it foundered and sank off the coast of Newfoundland last October. The cargo ship was carrying ammonium nitrate and calcium nitrate when they shifted under heavy seas, according to the internet *Cargo Letter* ([www.interpool.com/](http://www.interpool.com/)). Five crew members could not be saved, but, according to the AP article, the survivors "were lucky another ship was within the short range of the walkie-talkie when their satellite-based systems proved useless."

The report leaves some intriguing questions. Was the satellite system useless because it failed, because no one could man it, or simply because they needed immediate help?

Check out the internet site mentioned above to view the rigors of life in commercial shipping — from pirates to exploding boilers!

## Hoax Call Capital No Longer?

Coast Guard officials aren't exactly sure why, but false distress calls along the South Shore of

## BULLETIN BOARD

### May 28, Grimeton LF transmission



The historic Grimeton Transmitter will be on air at May 28, 1998, probably at 11.00 CET and 15.00 or 16.00 CET (on longwave 17.2 kHz?). Also test transmissions are planned a day or two before. EDXC 98 (see August 27) will be visiting this site.

### June 7: Butler, PA

44th Breezeshooters' Hamfest (largest in western PA) at the Butler Farm Show grounds, north of Butler (PA Rt 68 East from I-79). Contact Bob Ferrey Jr. N3DOK 712-367-2393 or see <http://www.users.sgi.net/~wolfie/> for info. Talk-in 147.96/36. \$5 admission.

### June 7: Queens, NY

Hall of Science ARC Hamfest held at the NY Hall of Science parking lot, Flushing Meadow Corona Park, 47-01 111th St. Contact Stephen Greenbaum WB2KDG 718-898-5599, WB2KDG@bigfoot.com. Free parking; prizes, food. 9a.m. - 3p.m. \$5 donation. Talk-in 444.200+ PL 136.5.

### June 14: Knoxville, TN

"Back to Basics" hamfest/electronics flea market sponsored by RAC of Knoxville, at National Guard Armory, 3330 Sutherland Ave. Contact Carol Whetstone N4LFR, 423-673-0475, or PO Box 50514, Knoxville, TN 37950-0514, rack@korrnet.org; <http://www.korrnet.org/rack>. FREE outdoor tailgate space with admission. VE exams (register before 1:30 pm), prizes, refreshments, free parking. Talk-in 147.30+ / 224.50- / 444.575- ; 9 am - 4pm; \$5 admission.

### June 20: Dunellen, NJ

Raritan Valley Radio Club '98 Hamfest at Columbia Park near intersection of Route 529 and 28. Contact Bob Pearson, 908-846-2056, RWPEARSON-WB2CVI@WORLDNET.ATT.NET. Talk-in 146.625(r) 447.250(r) tone 141.3, 146.520(s). 7am/2pm; \$5 admission.

### June 21: Monroe, MI

Monroe Hamfest sponsored by Monroe County Radio Communications Assoc, at the Monroe County Fairgrounds, 2 miles west of Monroe on M-50. Contact Fred VanDaele KA8EBI, 4 Carl Dr, Monroe, MI

48162, 313-242-9487 (after 5pm). Talk-in 146.72; 7:30a.m. - 1p.m.; admission \$5 at door.

### August 27-30 (June 15 registration)

European DX Council conference (EDXC 1998) in Göteborg, Sweden, sponsored by TERACOM. Registration (SEK 850) due by June 15 to EDXC 98, The Radio Museum, A Carlssons gata 2, SE-417 55 GÖTEBORG, SWEDEN. See [http://hem1.passagen.se/sm6kri/edxc/edxc\\_98.html](http://hem1.passagen.se/sm6kri/edxc/edxc_98.html) for program, transportation, hospitality details.

### Club News:

- Congratulations to the New Zealand Radio DX League, celebrating its 50th anniversary this year.
- Correction: ACARS-Link home page <http://patriot.net/~acars/index.htm> To subscribe, go to majordomo@qth.net and enter *subscribe acars*
- Visit the International Radio Club of America website at <http://fly.hiwaay.net/~waholler/irca.htm> - Sample of the *DX Monitor* on broadcast band DXing is available in the US for a first class stamp.

## Maritime Monitor Extraordinaire: Hank Holbrook: 1929 - 1998

It is our sad duty to report that Henry ("Hank") Holbrook died of leukemia on April 15 at the age of 69. "Hank was an avid DXer (all band/DC to light) and chased after QSLs from everything he heard — VHF draw bridges, ships, broadcasters, TIS, VHF/UHF comms, etc." says Larry Van Horn. "If Hank could hear it, he would QSL it."

Hank's logs and QSL reports appeared regularly in *Monitoring Times* and in club magazines. According to Bill Harms of Elkridge, Md., "about one month ago, he told me he had verified over 16,000 separate radio stations... his enthusiasm for the hobby was contagious." Rick Albright of Merced, Cal., agrees: "His loggings and QSL reports in *MT* have challenged me time and again to try to repeat his maritime monitoring successes. I did not know him, but I feel as though I did."

Mark Calderazzo no doubt fueled Hank's zeal for QSLing ships. He says, "I had the good fortune to have provided Hank his first tour aboard a real live working ship while in Baltimore in response to one of his reception reports of radio communication from my ship *M/V Sea Fox*, KBGK."

We trust Hank's meticulous collection of loggings and verifications — equally the project of his wife Mary Ellen — will find a good home somewhere. Our condolences go to Mary Ellen and his daughters Melanie and Martha. Hank will not be forgotten by all those who were inspired by his enjoyment of life and his love of a good radio challenge.



Long Island have fallen to their lowest level since 1992 in this area which has long held the worst record in the nation (see Jan 1998 *MT*). Presumably it was a winning combination of public education, stepped up prosecutions of offenders, plus upgraded direction finding equipment.

## Morale Boosters

Sailors at sea are used to long stints away from shore, but the duty is even harder when aboard a submarine. Generally these sailors only receive occasional updates on world events and are allowed eight 40-word telegrams from family members during their three months at sea.

Amateur radio volunteers with the Military Affiliate Radio System (MARS) help alleviate the situation, especially those at Kings Bay Naval Submarine Base. This group particularly targets the submarine crews by sending local news and sporting events for the enjoyment of off-duty sailors.

The newest morale-booster is the availability of e-mail. According to the *Baltimore Sun*, sailors aboard 300 of the Navy's 347 ships have been given access to email. "I don't see how we did without it!" was the opinion of Lt. Ken Linkous, who, for the first time in four tours in the Mediterranean, was able to communicate daily with his family.

"The tyranny of distance is the biggest impact on morale," said Rear Admiral Kendall Pease, "and we're closing that distance.... Mail call has taken on a whole new meaning." But, as one sailor cautioned, "If you want to say private things, you write a letter."

## Bits and Pieces

Here's a tally of some other radio stories in the news over the past few months:

### Persons accused of using scanner illegally

- Former narcotics investigator Dean Ward indicted for intercepting cellular and paging messages without an authorized wiretap; apparently using equipment and software which allowed him to target specific persons and conversations.
- Vidalia, Ga, police chief, accused of listening to and recording cordless phone conversations of Ga. Bureau of Investigation officer.
- Former Lawrence, Ma., police officer one of three suspects in bank robberies; scanner and police radio found in possession.

### Scanner used in apprehension of lawbreakers

- Oak Forest, Il: 13-year old prankster had been breaking in on police frequency for two weeks. Located by neighbor with scanner.
- Winchester, Md, bank robbers apprehended after being spotted on the highway by news photographer with a scanner in his car.

*Communications is written by Rachel Baughn with help from these fine reporters who sent in email and clippings from their world of radio: Anonymous, NY; David Alpert, NJ; Desperado, NY; Kenneth Dupuis, NY; Darrell Gammon, NC; Steven Gibson, CA; Patrick Goodwin, MA; Paul Hampton, TX; Adam Herst, ON, Can; Glenn Jones, GA; Maryanne Kehoe, GA; Kevin Klein, WI; John Kozak, OH; Ken Lensing, AZ; Pat Martindale, E. Yorkshire, UK; Palomar Engineers, CA; Mike (Pheel?), email; Van Reynolds, email; Mike Roth, IL; Keith Russell, MO; Richard Schultz, KY; Larry Van Horn, NC; Mike White, NC; William Woods, VA; and Globe Wireless, CA.*

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# Marine Monitoring on the **Chesapeake**



*Baltimore ranks in the top 20 of US ports just behind New York City and Norfolk.*

**By Ronald A Perron**

**T**he Chesapeake Bay is one of the largest inland waterways in America. From its mouth at Cape Charles to the Port of Baltimore it's about 200 miles long and varies from 4 to 40 miles in width. It's even longer if you count the Chesapeake and Delaware Canal, a 19 mile waterway that provides access to the Wilmington, Delaware and Philadelphia port areas.

The Chesapeake is also one of the busiest waterways. With the Port of Baltimore at its head and Hampton Roads and Norfolk at its mouth there's no lack of commercial maritime traffic in the Bay. According to the folks at the Maryland Port Administration about 1,800 vessels called at



*The Baltimore — one of four pilot ships which have guided thousands of ships through the Port of Baltimore.*

Baltimore in 1997 carrying more than 25.5 million tons of cargo.

Baltimore ranks in the top 20 of US. ports

and it ranks just behind New York and Norfolk along the East Coast. There's a busy communications structure supporting this amount of ship traffic.

## ■ Commercial Maritime Communications

As you might imagine, navigating large vessels in the narrow confines of the Chesapeake can be a challenge. The Maryland Pilots Association is more than up to that challenge. Their four pilot vessels and 65 pilots guide several thousand ships per year through the sometimes tricky waters of the Bay.

These Maryland pilots point proudly to a

long history of maritime service. Founded in 1852, they are the oldest association of maritime pilots in the country. They have an enviable safety record and can brag about many firsts; the first purpose-built steam pilot boat; the first minority pilot in the US; the first female pilot in the country; and one of the first users of the Differential Global Positioning System for precise navigation in the harsh winter conditions of the Bay.

The average pilot has more than 25 years of service on the Bay and throughout their career has guided several thousand ships to and from the Port of Baltimore. The pilots use standard maritime VHF-FM radios to conduct their operations.

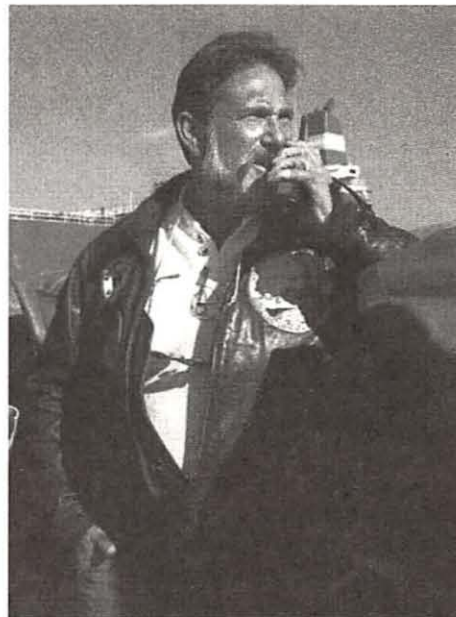
One of the more unique aspects of the Port's communications environment is its pollution control efforts. The Port Authority and the US Coast Guard are very serious about protecting this fragile enclosed waterway. One of the major players in the pollution control area is Industrial Marine Services (IMS) Inc. This Norfolk-based firm has a branch operation in Baltimore. I talked with the manager Captain Bob Garza. He says that they routinely standby on maritime channel 16. They also use channel 6 for port operations and channel 13 for bridge-to-bridge and ship-to-ship communications.

Bob says that, overall, the Chesapeake has been lucky. There has not been a major oil spill, ala *Exxon Valdez*, though with the amount of ship traffic in the Bay the possibility is certainly there. According to Coast Guard figures, in the last few years there have been several spills totaling more than 137,000 gallons. Of the total spilled, almost 118,000 gallons were recovered — so the recovery operations work well. Hopefully, there won't be major spill, but Bob says his company, the Coast Guard and others, are ready just in case. If past experience is any indication, they know how to do their job.

Just to make sure that everything is in order there are periodic pollution control exercises. Sponsored by the shipping industry, the preparation drill includes industrial, local environmental groups, local, state and federal government agencies in a one-day, 12 hour exercise. The next one is tentatively scheduled for late 1998.

#### ■ Coast Guard Operations in the Chesapeake

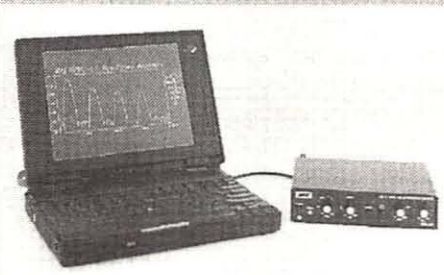
Coast Guard operations in the Upper Chesapeake Bay are under the control of a relatively new organization, the US Coast Guard Activities Baltimore. Activities Baltimore is a prototype Coast Guard organization combining



*Left, Capt Charles Miller, CO of Activities Baltimore, aboard the buoy tender Red Birch. (Photos courtesy Port of Baltimore magazine.) Right, Bob Garza, manager of Industrial Marine Services (IMS) Inc., keeps in contact with ships coming into the Chesapeake from on board his oil spill response vessel.*

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the former Marine Safety Office with their traditional operations group. There are three Divisions in the new organization; the Response Division; the Prevention Division; and the Investigations, Auditing and Analysis Division.

The Response Division supervises and manages all Coast Guard assets initiating or controlling first responses. The Division oversees the operations of six small boat stations along the Chesapeake at Station Annapolis; Station Curtis Bay (Baltimore); Station Taylor's Island; Station Stillpond; Station St. Ingoes; and Station Crisfield.

Activities Baltimore consists of more than 125 officers, enlisted and civilian personnel. Each station is equipped with 41-ft utility boat (UTB) and a 21-ft or 19-ft rigid hull inflatable boat (RHIB). Additionally, the Activities employs a 157-ft buoy tender *Red Birch* (WLM 687) which conducts normal navigational repairs, etc. The *Red Birch* was specially designed to double as an icebreaker to keep the Bay's shipping channel open to navigation during winter.

Coordinating the communications of all these assets is the responsibility of the Activities' Communication Center. They handle all port security, environmental response and prevention, distress and law enforcement cases. The Center continually monitors channel 16 as part of the National VHF-FM Distress System using seven high-level transmitter sites to maintain coverage of their area of responsibility. One of these repeaters is located atop the Chesapeake Bay Bridge which spans the Bay near Annapolis. This repeater is about 250 feet above the surface providing extended coverage for the southern portion of the Activity's area. Activities Baltimore maintains a 24-hour radio guard while

the subordinate stations maintain a live radio watch from 0600 to 2200 and anytime there is a station vessel underway.

### ■ State Police to the Rescue

The reorganization of Coast Guard assets nationwide is causing the relocation of rescue aircraft further away from the Chesapeake. Presently the closest aircraft are located at US Coast Guard Air Stations at Cape May, New Jersey, or Elizabeth City, North Carolina.

To fill this void Coast Guard Activities Baltimore and the Maryland State Police have entered into a unique partnership. Under a 1997 memorandum of understanding the State Police Aviation Unit has assumed the primary responsibility for airborne search and rescue on the Bay. The State Police Aviation Unit, headquartered at Baltimore's Martin State Airport, operates a fleet of eight helicopters and two fixed wing aircraft. Several of the helicopters are deployed to key locations around Maryland to speed response times.

I talked with Lt. Ladonne of the Aviation Unit who says that during the height of the busy recreational boating season it's not unusual for the Unit to respond a couple of times per day to calls to assist the Coast Guard. When

responding to the Coast Guard the helicopters will initially establish communications on maritime VHF channel 16. They will then switch to one of the Activities' duty frequencies.

### ■ Agency Cooperation Makes For Interesting Monitoring

This past winter I monitored a couple of interesting episodes involving Activities Baltimore. One very foggy evening, a pleasure craft, taking advantage of our mild winter, had lost its way outside Baltimore harbor.

Activities Baltimore maintained communications with the vessel while vectoring one of the harbor's tugs, which happened to be out working, to the area. They got the tug's captain to blow his horn and whistle at regular intervals so that the disoriented pleasure craft could come alongside and follow the tug to safe anchorage.

Another incident demonstrated the close working relationships that exist between Activities Baltimore and local agencies. On one of the warmer winter days we had this year, two fishermen were stranded on the Bay after dark with engine trouble. The Coast Guard coordinated search efforts between the State Police helicopter and local county police. The Coast Guard communicated on VHF-FM marine channels while the helicopter used VHF with Baltimore Washington airport controllers and low-band VHF with their dispatcher. The local police efforts all took place on the county's 800 MHz trunked system. Needless to say it took some nimble fingers to keep up with the flow of communications.

The monitoring activity on the Bay has been fairly good most of the winter. Now that summer is here it will really be exciting. As an example of just how busy it can get, in 1996 Activities Baltimore conducted over 1200 law enforcement boardings and executed almost 700 search and rescue operations.

The Bay is such a popular recreational boating area that on good days you'd swear you could almost walk across the Bay by stepping from sailboat to sailboat. The normal seasonal increase in commercial marine activity coupled with the summer onslaught of recreational boaters means that my scanner's marine band channels will really get a workout. I'm looking forward to a busy summer.



# Chesapeake Bay Maritime Communications

I monitor the Chesapeake Bay communications using a Radio Shack Pro-2045 receiver and a Diamond D-130J discone antenna mounted about 30-ft above the ground. Tune in these frequencies for Chesapeake Bay area maritime communications (MHz):

## Port of Baltimore:

156.55	Maritime channel 11	Local usage
156.65	Maritime channel 13	Ship-to-ship
156.800	Maritime channel 16	Emergency

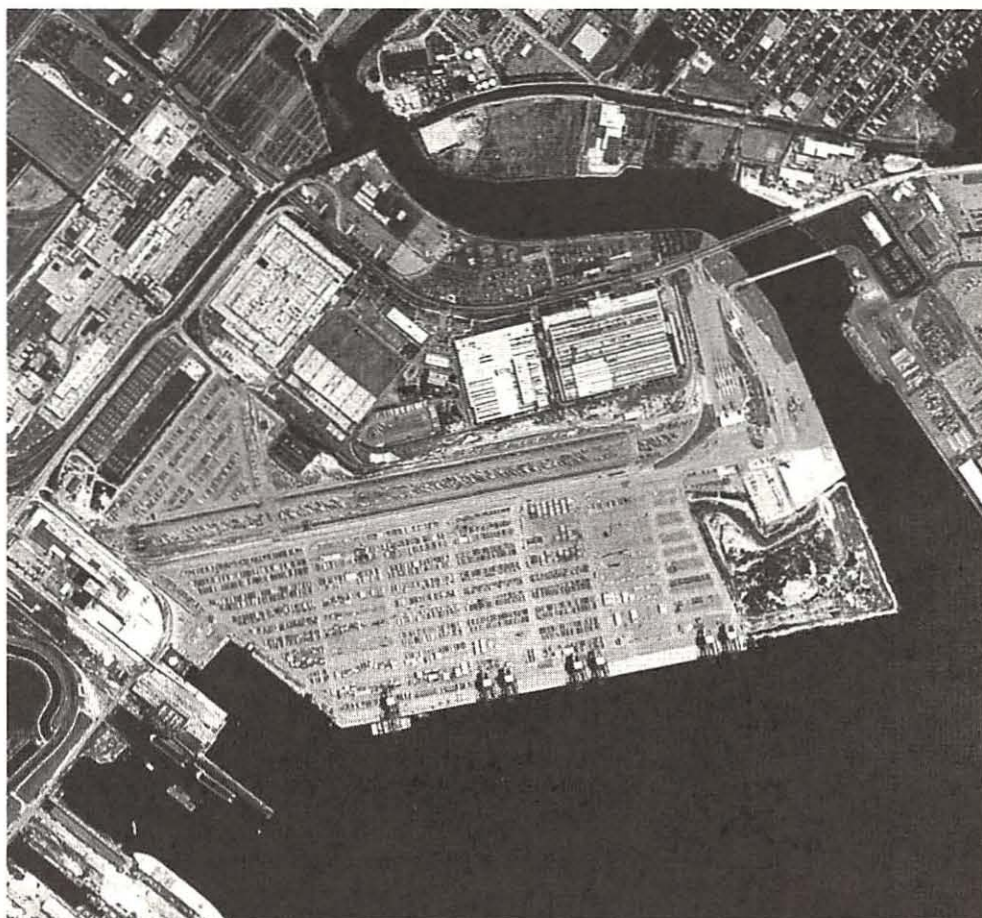
The Port's four pilot boats, *Baltimore*, *Calvert*, *Vedette*, and *Maryland* communicate on these frequencies using their names as callsigns.

The Industrial Marine Service operates a 28-ft harbor tug, the *Oil Spill Response* and uses 156.300 (channel 6) for their company communications.

There are also several water taxis using 156.425 (channel 68) in the Baltimore Harbor area. These taxis shuttle tourists among the various harborfront attractions and restaurants in the Inner Harbor area.

## US Coast Guard Activity Baltimore:

156.800	Channel 16	Emergency
157.050	Channel 21	
157.075	Channel 81	Pollution Control
157.100	Channel 22	
157.125	Channel 82	
157.150	Channel 23	
162.125	Tactical	
162.165	Tactical	
165.2625	Tactical	
162.325	Tactical	
164.300	Law Enforcement	
165.2625	Law Enforcement	
165.3125	Law Enforcement	
165.3375	Intelligence	



143.280	Coast Guard Auxiliary
143.875	Coast Guard Auxiliary
148.305	Coast Guard Auxiliary
148.825	Coast Guard Auxiliary

In our area the Coast Guard Auxiliary also operates at least one aircraft probably used for aerial surveillance/search and rescue. The aircraft uses callsign *2 Juliet Kilo* which probably represents the last three letters of its registration. Baltimore Activity communicates with the aircraft on 157.15 (channel 23). The aircraft uses normal VHF approach frequencies (119.0/119.7/128.7/125.525) to communicate with airport controllers.

The Maryland State Police Aviation Unit works with the Coast Guard on channel 16 and any other marine channel that Activity Baltimore is using. They also will work on their normal dispatch channel 44.74 MHz using their normal *Trooper* callsign.

## Curtis Bay Shipyard:

419.6565	Security
419.850	Fire
407.125	Shipyard
415.775	Shipyard
416.6375	Shipyard

The Coast Guard maintains a working shipyard in Baltimore. The yard repairs Coast Guard vessels and builds specialized vessels to Coast Guard requirements.

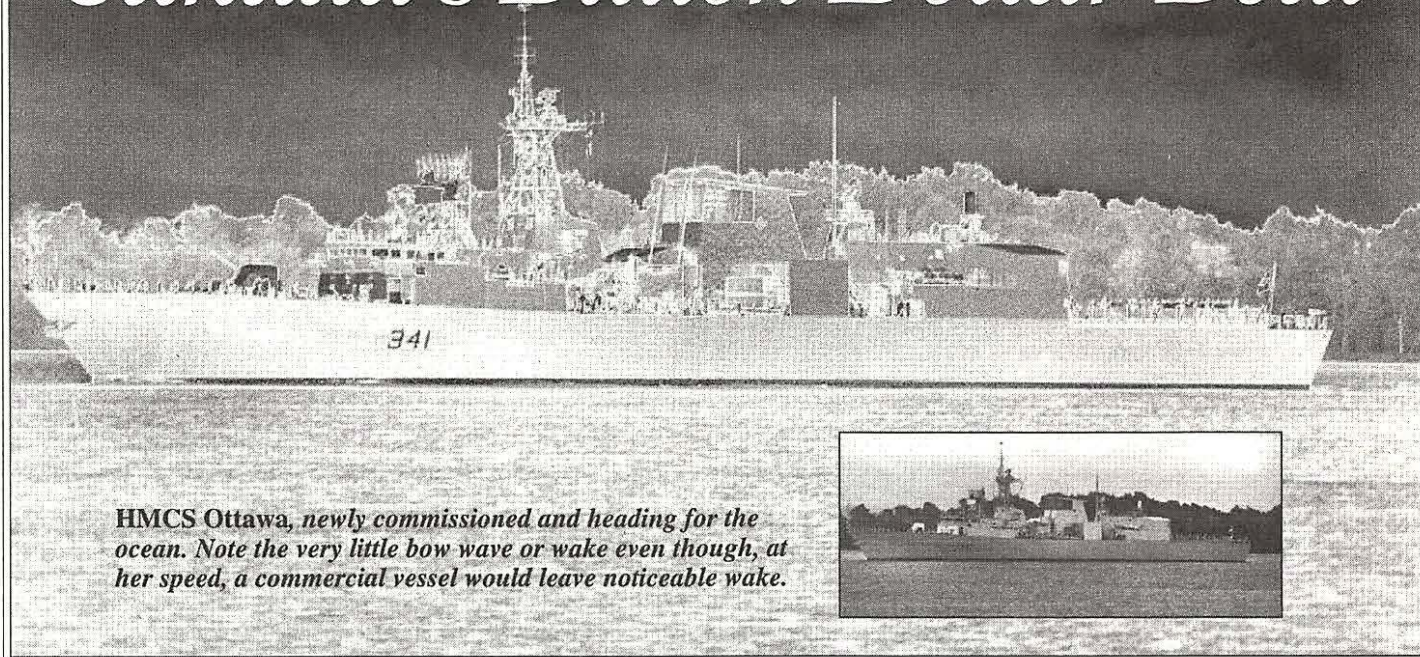


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# An Antenna Tour of Canada's Billion Dollar Boat



*HMCS Ottawa, newly commissioned and heading for the ocean. Note the very little bow wave or wake even though, at her speed, a commercial vessel would leave noticeable wake.*

By Dave Holford

**H**MCS Ottawa (FFH-341) is the fourth Canadian warship to bear the name of the nation's capital and the last of 12 Halifax class helicopter frigates. She was commissioned on September 28, 1996, and joined the Canadian Pacific Fleet, based in Esquimalt, British Columbia.

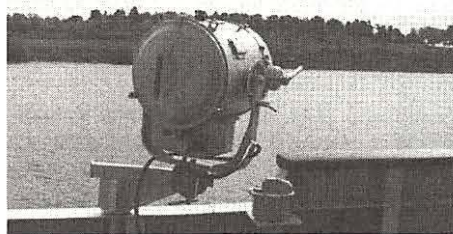
Modern warships are so reliant on electronic systems that they end up looking like floating antenna farms. Antennas far outnumber weapons — and that is just the ones that look like antennas. Some are so strange that they could easily be mistaken for something else. Indeed, several people on the tour I took thought the dual whip HF antennas were guns.

HMCS Ottawa was designed from the keel up for electronic warfare. She is stealthy to hide her from prying radars and sonars, and festooned with communication, navigation, intercept, jamming and radar antennas. There are visible antennas covering the entire spectrum from 10 kHz through to at least 18 GHz. Underwater there are sophisticated fixed and towed sonar systems.

If detected and attacked, her first line of defense is deception. For aircraft and missile targets she carries sophisticated jamming and deception systems, including 24 chaff and flare decoys; and if attacked by submarines she carries torpedo countermeasure systems.

By definition a warship must be prepared to fight and the Ottawa is well equipped to do so with guns, missiles and torpedoes.

But the weapons are only used when it gets down to actual combat. She is always using



*The highest frequency system on board: the good old fashioned, hard to intercept, and unjammable signal lamp!*

her electronics systems to communicate, navigate, and probe the sky, surface and waters around and under her to detect, track, and identify any object of potential interest. This requires antennas: dozens of antennas of all shapes and sizes, operating throughout the electromagnetic spectrum. And, at the top of the spectrum, she mounts four old reliable signal lamps, two on each side of the bridge.

The square, boxy appearance of much of the superstructure is part of the "stealth" design. The tall structure midships, which looks as if it has panoramic windows, is actually covering the funnels and who knows what else? The "windows" are metal screening very much like the screens over the air intakes of the F-117 stealth fighter. The square object just behind it covers vertical launchers for Sea Sparrow missiles. The large structure further back is the helicopter hangar.

From the number of obvious antennas and the large number of things which look like they might be antennas (not including the sonar systems which are not visible), I would



**Close up of the main mast showing numerous bonding wires and, if you know where to look, the feedlines for the HF wire antenna.**

guess that probably half or more of the billion dollars each of these vessels cost was spent on electronics. It would be interesting to know how many of the approximately 225 crew members are directly involved in the electronic aspects of warfare ... It is also worth noting that about 25 percent of the crew of this first line combat vessel are women.

The entire vessel is protected against EMP (ElectroMagnetic Pulse) from nuclear explosions. Even the window frames on the bridge each have two heavy gauge wires bonding them to the surrounding structure.

Although I did manage to take a few photos on the bridge, not much can be deduced from the communications consoles. All are identical in appearance and are obviously programmable for everything from intercoms to any of the many voice radio systems — maybe even the cellphone (yes, there is a cellphone because I saw the notice warning against using it for personal messages).

There are also notices warning of HF radi-



tion for most areas topside except walkways and the helicopter deck.

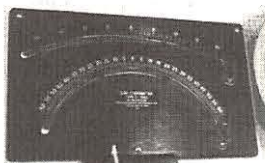
The weapons control console is simplicity itself: GUN is the 57 mm rapid fire Bofors mounted forward of the bridge. TORPEDOES are mark 32 and 46 homing types and are launched from a pair of tubes on each side. CHAFF refers to the chaff and flare missile decoys which look like small rockets and are mounted in four groups of six. HARPOON anti-shiping missiles are carried in four launchers, two each side; and SEA SPARROW anti-aircraft missiles are mounted in vertical launchers with eight on each side.

If an aircraft or missile gets through all the jamming, decoys and other weapons, it still has to face the CIWS (Close In Weapons System), a phalanx gatling gun which fires 3,000 rounds per minute of 20 mm cannon shells and is equipped with its own detection and tracking radars mounted in a small radome at the aft end of the helicopter deck.



**Weapons station. Note the simplicity: two push buttons/indicators for each system. The top one indicates the status as either Enable or Veto. The bottom one is a Veto push-button, and then there is a Master Veto.**

I couldn't resist a shot of the ship clinometer which is calibrated for up to 60 degrees either side of vertical. I



think 60 degrees of list is more than I would care to experience in a ship this size!

#### ■ Warship antennas

The problem with a modern warship is that you need lots of antennas, but there is little room for an antenna farm. Especially since they must be kept clear of the firing path for missiles, guns and decoys. So what do you do? Squeeze in as many as you can, bearing in mind that some will be connected to very sensitive wide band receivers, while others will be radiating high power at the same time.

While there are lots of antennas, some of which may not be recognized as such, there are also other fixtures which may look like antennas but are not. Many wires run around the topside which are just bonding to prevent resonances and other RF interactions from parts of the superstructure.

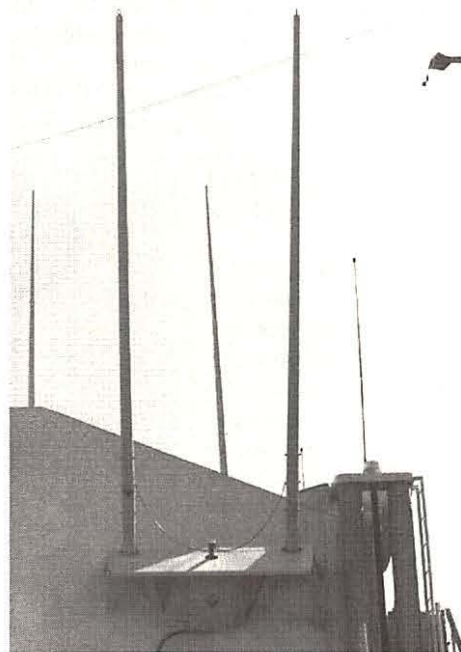
There are lots of whips — which may be anything from 100 kHz LORAN-C navigation signals through to UHF, and several "pipes" which may have helical HF, VHF/UHF dipoles, or other assorted contents. Note that antenna tuners are where they belong —

at the antenna, not the transmitter.

Wire antennas radiating out from masts are not in reality the horizontal antennas which they might appear to be. Ships prefer to use vertical polarization, since it provides both less attenuation over sea water and omnidirectional radiation so that a ship can communicate in all directions. This is achieved by using the mast alone or in combination with other parts of the superstructure as part of the antenna. The wires are really a capacitive hat used to increase the effective height of the real radiator. Although they can be configured for other ranges, a fan of the type observed on *HMCS Ottawa* typically is used as a transmitting antenna for the range 2 to 6 MHz and may also be used as a receiving antenna for the range 2 to 12 MHz.

Twin whip HF antennas are widely used because of their broad-band characteristics. A pair of 35 foot whips spaced 10 feet apart and fed from a common feedline can be used over the frequency range of 4 through 12 MHz. A pair of 12 to 16 foot whips spaced about 5 or 6 feet works well from 10 to 30 MHz.

Wide band antennas permit using a single antenna for multiple transmitters and receiv-



**Close up of the Starboard pair of HF whips for 10 to 30 MHz. Note the common feed and the antenna tuner in the box under the mount. The sticker reads "WARNING radio frequency shock hazard." The thin whip on the right appears to be for low band VHF, and the other two are the low frequency HF pair on the port side.**

ers at the same time. Multicouplers used on modern warships permit operation of transmitters within less than 10 percent of the frequency of a simultaneously operating receiver on the same antenna. So, it would be possible to listen to WWV on 10 MHz using the same antenna which was being used by high power transmitters operating at 9 and 11 MHz, without affecting the operation of the receiver.

If you want to know more about naval antenna systems I suggest that you get a copy of *Shipboard Antennas* by Preston E. Law Jr., published by Artech House Inc. For more on the Canadian warships, here are some websites of interest:

HMCS Ottawa home page:  
<http://www.pacificcoast.net/~hmcsoottawa/mainen.htm>

The Canadian Pacific Fleet:  
<http://www.dnd.ca/navy/marpac/site1/eng/marpac/shiplist.htm#CPF>  
 The Canadian Atlantic Fleet:  
<http://www.marlant.hlfx.dnd.ca/marlant/mar002e.html>

#### ■ Antennas on the Ottawa

Wherever I could, I have included the designation with which I am familiar, although the antennas on the *Ottawa* could be later models with a new designator.

On top of the main mast is an AS-3240 TACAN antenna for helicopter navigation. The disk is the antenna itself and the vertical object to the side is a 6 foot lightning rod.

Next is the SLQ-504 intercept receiving antenna set — three antennas covering 500 MHz through 18 GHz. At base of the mainmast, side mounted on both port and starboard, are the SLQ-503 wide range jamming antennas: a pair of radomes separated by what look like circular saw blades.

UHF satcom uses the AS-3018 antenna, which looks like a section of an oil drum. It covers the range of 240 to 318 MHz with a gain of 12 dB and a transmit power rating of 400 watts. These are mounted in pairs to ensure that at least one can always see the satellite.

A number of antennas, which can be seen in some photos but are not obvious, look like a pair of crossed loops open at the bottom and mounted above what looks like crossed VHF dipoles. These are AS-2815 receive only satcom antennas. Installed in sets of four to provide all round coverage, they operate from 248 though 255 MHz.

There are at least three HF antennas. An array of wires is commonly used to provide top loading for the main mast, which is used for 2 through 6 MHz. This one is different, in that in addition to the normal fan of wires to forward there is a single wire to aft which terminates at a metal box. What's in the box? Good question: maybe a loading coil or terminating resistor, I don't know. But careful visual examination failed to disclose any sort of control cable which could be used for tuning, so whatever it is does not appear to be adjustable.

The wire fan antenna on *HMCS Ottawa* appears to be covered with an insulating coating which indicates that it is used for receiving or transceiving. Naval wire antennas are made

of phosphor bronze which is corrosion resistant. Therefore, the only reason for insulating them is to provide protection against precipitation static, which has no effect on transmitters.

The other main HF antennas are pairs of vertical whips on either side. The port side has a pair about 25-30 feet long and separated by 8-12 feet, and are used for the low end of the HF band from about 4 to 12 MHz. The starboard pair are about 12-15 feet long and separation is about 4-6 feet. They are for the range 10 to 30 MHz. I found it interesting that the port pair were inclined a few degrees from the vertical, while the starboard pair were in-

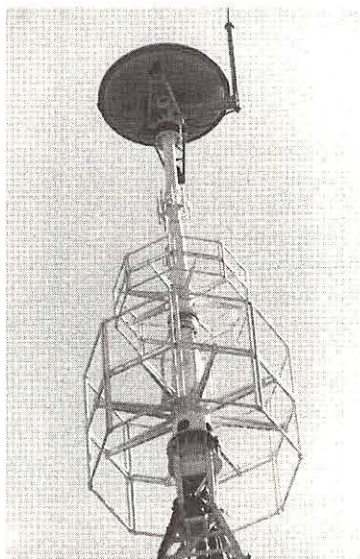
clined at a much greater angle — no one could, or would, explain why this difference.

While the wire array on the mast may be fed to multiple transmitters and receivers simultaneously, it is unlikely that the twin whips have the same capability since their antenna tuners are mounted at the base of the antenna and fed with a single feedline. Although the wire array can typically be used to feed multiple transmitters in the range 2 - 6 MHz and simultaneously feed several receivers in the range 2 - 12 MHz, this may not provide all the HF receiving capability required.

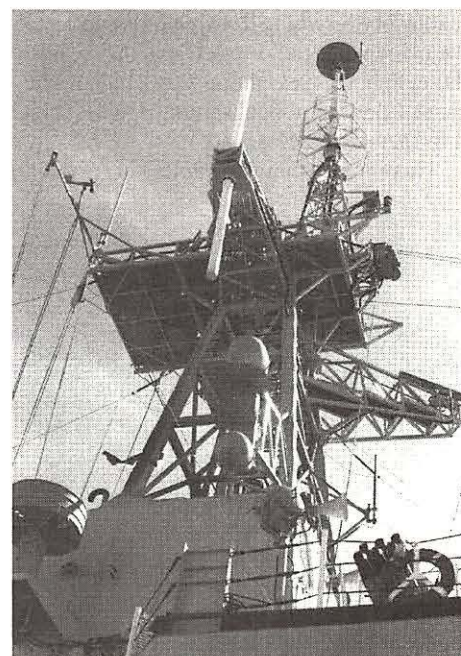
Extra receivers may be coupled, or multicoupled, to other single whips observed aboard. There are many whips scattered around the vessel, but it is difficult to determine their precise purpose, since shipboard whips are used from VLF through UHF.



**Bridge and mainmast.**  
*TACAN at top, intercept antennas below with five radars, jammers, satellite and a multitude of other antennas visible if you look closely.*



**Close up of top of mainmast.**  
*Round antenna with vertical beside it is TACAN. All the white antennas below are part of the intercept system for detecting signals in the range 500 MHz through 18 GHz.*



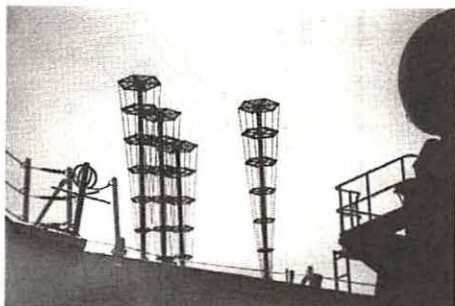
**Side view of mainmast.** *Bottom left is satcom, bottom centre is signal lamp and bottom right (behind lifebelt) is missile decoy launcher. Top of mast is TACAN, below that are intercept antennas. Multiple wires attach to mast platform, navigation radar juts out to right. Large dipole on side and below it is the jamming system.*



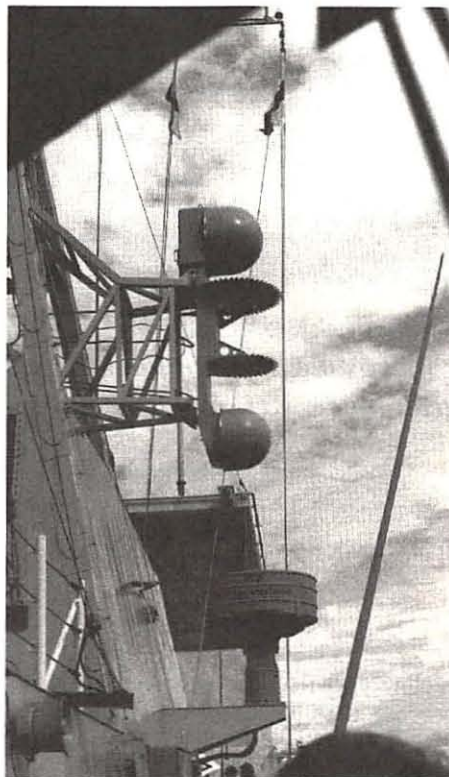
Close up of jammers on starboard side looking aft from bridge. Note "birdbath" UHF satcom antenna below jammer, and HF dual whip pointing off at about 45 degree angle.

An array of four vertical antennas reminiscent of cage antennas is mounted in a triangular pattern on top of the helicopter hangar. I was not able to make an accurate estimate of length but would guess that they are probably for the lower portion of the VHF range. Presumably they can be operated as a phased array which would enable them to be used as a direction finding system for frequencies below those covered by the intercept antennas mounted on the topmast. The cage construction should provide reasonably wide-band capability.

The *Ottawa* also carries a variety of radars, including: Raytheon SPS-49 C/D band 250 nm range air search. Ericsson Sea Giraffe HC-150 G/H band 55 nm range air and surface search. 2 Signaal VM-25 STIR-124CA K/I band 76 nm range fire control. Sperry MK340 I band navigation.



Close up of the mystery verticals on the helicopter hangar. The round object to the right is a fire control radar and the tilted post on the left is a satcom antenna.

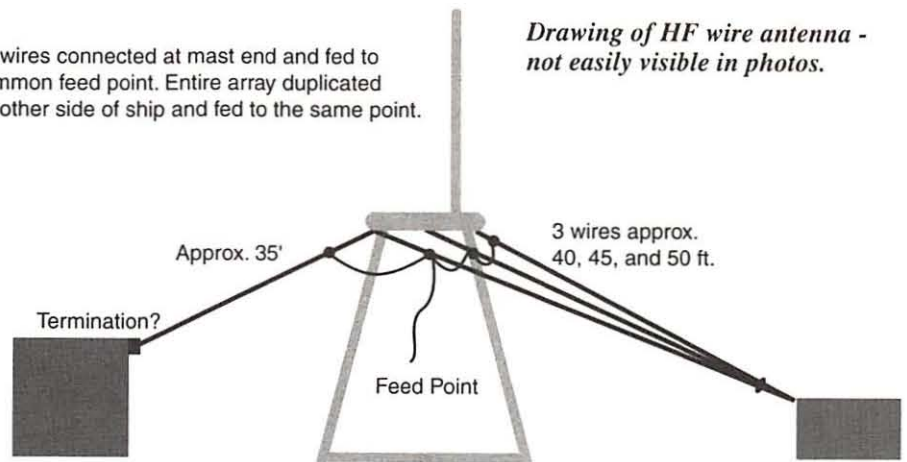


Port view aft from bridge. The whip pointing skyward at an angle is actually the pair of HF whips. Jammer antenna at centre; the thing that looks like an overgrown birdbath is a UHF satcom antenna.



Roof of helicopter hangar with phalanx CIWS with its distinctive white radome (Radome contains both search and track radars), three of the unidentified verticals and a fire control radar. This area also contains satcom antennas but they are very difficult to see.

All wires connected at mast end and fed to common feed point. Entire array duplicated on other side of ship and fed to the same point.



Drawing of HF wire antenna - not easily visible in photos.

#### HALIFAX CLASS FRIGATES

Name	Side number	Fleet
Halifax	330	Atlantic
Vancouver	331	Pacific
Ville de Quebec	332	Atlantic
Toronto	333	Atlantic
Regina	334	Pacific
Calgary	335	Pacific
Montreal	336	Atlantic
Fredericton	337	Atlantic
Winnipeg	338	Pacific
Charlottetown	339	Atlantic
St. John's	340	Atlantic
Ottawa	341	Pacific

#### Weapons

57 mm Bofors 220 rpm.  
 GE Phalanx 20 mm 6 barrel gatling gun 3,000 rpm.  
 16 Sea Sparrow Surface to Air Missiles in vertical launchers.  
 8 Harpoon Surface to Surface Missiles, all weather sea skimmer, range over 60 miles.  
 Mark 32 and Mark 46 homing torpedo, can be launched by both the ship and her helicopter.  
 6 50 cal machine guns.

#### Electronic systems

MEL/Lockheed SLQ-504, 500 MHz to 18 GHz intercept system.  
 MEL/Lockheed SLQ-503 jammer.  
 Towed array sonar system in addition to a conventional SQS-505 hull mounted sonar and an SLQ-25 torpedo countermeasures system.  
 Fully automated combat data system including Link 11 and 14

#### HMCS *Ottawa*

Last of the 12 Halifax class helicopter frigates. Launched 31 May 1996. Commissioned on 28 September 1996.  
 Currently based in Esquimalt, BC.  
 Displaces 5,250 tons, Length 440 feet, Beam 54 feet, Draft 21 feet.  
 Speed in excess of 30 knots.  
 2 Gas Turbine main engines, 46,000 hp twin shaft.  
 8,800 hp Diesel auxiliary cruise engine.  
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- World time computer
- station name display
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- USB/LSB mode with 40 Hz step tuning
- 20 memory banks with automatic search



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- Tone control
- External antenna jack
- 22 scannable memory channels
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# DXing on the High Seas



Ross Cobb, Aerials Inc.

By Philip Gebhardt

**M**ention maritime DXing and chances are that everyone will imagine sitting in the comfort of their radio shack listening to long distance (DX) communications from naval vessels or perhaps cargo ships.

There is another aspect to maritime DXing, however. One that I discovered last December. And it's one that you can try, too.

I did my DXing, not from home, but from onboard a ship. I took a cruise, a Caribbean cruise.

After booking the cruise, I received a brochure from Royal Caribbean Cruises Ltd. The brochure asked — and answered — common questions landlubbers like me might ask. Two questions caught my eye. One: What can I do for fun on my cruise? Two: What do I need to bring?

The answers seemed fairly obvious. One: DX. Two: a receiver. (Obviously as these answers seem, neither of them appeared in the brochure.)

Actually, there was a third question and answer pair which clinched the plan for me. The question: Will I need an electrical adapter? The answer: All staterooms have standard 110V electrical outlets.

My initial plan was to plan was to take advantage of having a radio shack located over salt water and do some

mediumwave DXing. I also thought about shortwave and FM possibilities.

For shortwave DXing, I planned to use nothing more than the receiver's built-in, telescoping antenna. Next time I'll know better. For FM DXing, I packed a folded dipole and a 300-to-75 ohm balun. Next time I'll know

better. Had I planned ahead, I could have used some of my shore time to visit FM stations. One station's antenna in Cozumel, Mexico, was within sight as I stood on the ship's deck.

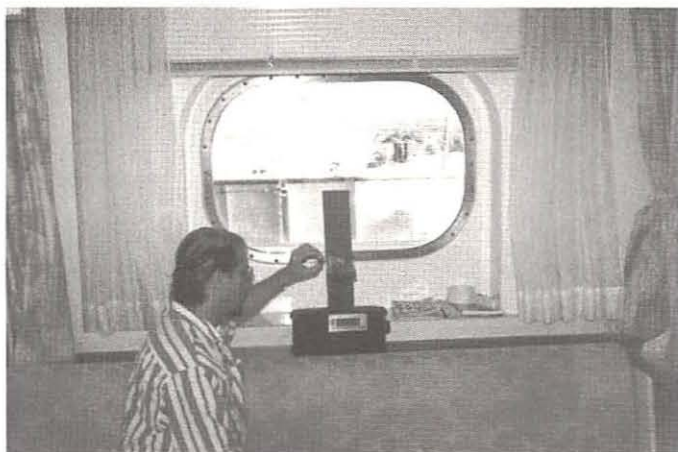
For MW DXing, I decided to take along a loop antenna. That was a good idea. But anyone who has built a home-made loop antenna knows that it takes up a lot of

space — even if it's only a small 30-centimeter (1-foot) box loop. You also run the risk of damaging the loop in transit. Instead of an assembled loop, I took the pieces so I could pack them easily in my suitcase and then constructed the loop on the ship. I had two wooden crosspieces for the frame, about 25.6 meters (84 feet) of wire for the loop, and the variable capacitor. (See "Get in the Mediumwave Loop," *Monitoring Times*, November 1996). At home, I soldered wire leads to the capacitor so I could twist the loop wire and the capacitor wires together later. Finally, I put double-sided tape on the capacitor frame so I could mount it on the wooden loop frame. The assembly went perfectly.

My radio shack for the 7-day cruise which started and ended in Miami, Florida, was the M/S *Majesty of the Seas*. My radio shack was 268.3m (880 feet) long and



*DXing on deck can be a real treat since you get to spend time outdoors in the fresh air and sunshine. There are drawbacks, however. The wind not only ruffles your hair, it also makes it difficult to hear weak stations. The sound of the water can also be a problem. Shown here is the loop antenna which I assembled on the ship. The tuning capacitor was attached to the wooden crosspiece with double-sided tape. Before heading home, I disassembled the antenna for easy packing and transport. From Cozumel, Mexico, I was able to hear ZNS1 in Nassau, Bahamas on 1540 kHz during the day.*



*If you are going to DX on board a cruise ship, you'll want to have a window so you can receive signals inside your stateroom. Along with your receiver and maybe a loop antenna, you'll want to bring some reference books, such as WRTH, Passport to World Band Radio, FM Atlas, and NRC AM Radio Log. Shown here is Philip Gebhardt doing some mediumwave DXing from inside his stateroom aboard the M/S Majesty of the Seas.*

32.6 m (106 feet) wide. It weighed 73941 tons. Although the four main engines had an output of 21844 kW (29707 horsepower) and the six auxiliary engines could provide 13320 kW (18115 horsepower), they didn't cause any radio interference. One concern was that at some point my receiver would slip overboard. The ship has 5.045-meter (16.55-foot), computer controlled stabilizers which eliminate about 90 percent of the roll. My receiver didn't disappear over the side.

The cruise took me to Labadee, Haiti; Ocho Rios, Jamaica; Georgetown, Grand Caymen Is.; and Playa del Carmen and Cozumel, Mexico. You can see a map of the route on Royal Caribbean International's website at <http://www.rcl.com>. Click on "places to go" and then on "itinerary details." Then go to "Western Caribbean-7 nights." You'll not only see the route, but also the position of Cuba and the Bahamas in relation to the route. As you would expect when you see the map, I heard many Cuban stations, both day and night. (The significance of the Bahamas will be clear shortly.)

I did some shortwave DXing from both my stateroom and outside on the deck. Reception was better outside, but there was nothing spectacular. Had I packed some wire for an antenna, maybe things would have improved.

I tried the same locations for FM DXing. Outside, I used the receiver's built-in, telescoping antenna; inside, I

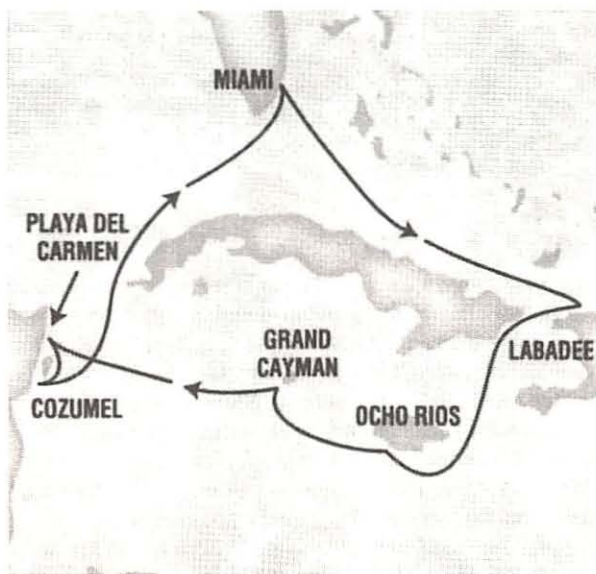
taped the folded dipole to the stateroom window. Again, nothing spectacular.

Medium wave was a different story. Using only the receiver (a Sangean ATS-803A), reception was not noteworthy from inside the stateroom. That is, until I assembled the loop antenna.

My first DX attempt from inside the stateroom was during the evening. Without the loop, I heard four stations. With the loop placed against the stateroom window, my DX count rose to 52 stations! Several were

U.S. broadcasters. My interest was piqued.

Flushed with success, I decided to try daytime DXing. The second day at sea, I heard Miami, Florida, on 610 kHz at 1615 UTC. I tuned to 1540 kHz and heard ZNS1 (Radio Bahamas) from Nassau. Although WIOD was only audible outside (on deck), I could receive ZNS1 both outside and in the stateroom. From my stateroom, I was able to consistently hear ZNS1 during the day as far away as the Cayman Islands — about 800 km (500 miles) from Nassau. I checked again when the ship arrived in Cozumel. ZNS1 was still there although I was outside. The distance? About 1120 km (700 miles).



Although the ship's engines did not interfere with reception, the sound of the wind and the water did. The wind blowing in my ears made it difficult to hear weak stations. Earphones are a necessity. Not only do they reduce the outside noise, they ensure that you do not disturb other passengers.

All things considered, my MW DX experiment was a success.

## ■ VHF/UHF, too!

For those interested in scanners, there are opportunities to exploit. Much of the onboard communications is done with handheld transceivers. There is communication between the bridge and security. The bridge is also in contact with crew members on deck as the ship docks and leaves port. Crew members including hostesses, activity leaders and the cruise director communicate using handhelds. There may even be a VHF call from shore if a passenger is going to be late for boarding. "My rental car broke down" is a good excuse and the ship's captain may wait for you; "I just had to have one more rum and coke" will likely justify leaving you behind on shore.

You can get a view of the M/S Majesty of the Seas on Royal Caribbean International's website. More importantly, you can see why my location on the ship was ideal for DXing. (Click on "ships and rooms" on the website. Then go to "ship viewer." Click on *Majesty of the Seas* and the "deck viewer.") My stateroom (#7508 on the Promenade Deck) gave me easy access to an outside deck. As the designation "Promenade Deck" implies, I could actually walk around the perimeter of the ship. On other levels, the staterooms extended to the edge of the ship, so there was no deck to walk on. I also had a window to the outside world. I could check reception in my stateroom and within a minute be outside on the deck checking reception there.

If you plan to do any DXing on board a cruise ship, you'll need to know where your stateroom is located. Having an interior stateroom without a window would eliminate DXing from your room — although not from outside.

## ■ Exploring the Communications Center

But you can't spend all your time on board the ship DXing. Fortunately, I had planned ahead. With the assistance of the Corporate Communications division of the cruise line and the permission of Captain Tore Nervik, I was able



**Gone are the days of messages being sent by Morse code. Here, Chief Radio Officer Terje Johnsen sits in the radio room in front of the console housing some of the ship's communications equipment including a 1 kW HF rig.**

to visit the Radio Room.

It was there that I met Terje Johnsen, the ship's chief radio officer. He is one of the two radio officers who man the radio room. Working 11 to 12 hours per day, they are on board the ship for 14 weeks then have 7 weeks off. The radio room is in operation from 8 a.m. to midnight. After that, incoming calls are routed to the Purser's desk.

Johnsen was in Norwegian Navy for 3 years and has been a radio operator on board ships for the past 37 years. He has worked aboard various ships including cargo ships in the North Sea.

Since the ship is registered in Norway, both the station's license and the officer's licenses are issued by the Norwegian government. The station's callsign is LAO14.

The radio room itself is about 8 meters (27feet) by 3 meters (10 feet). In it is a variety of equipment. Although most of the communications takes place on the VHF and UHF bands, the station is equipped with a 1 kW shortwave (HF) rig. Satellite equipment for receiving weather information and text news services (you can read the news daily on board) is fitted in racks. You can even make a phone call from the ship via satellite.

In this era of satellite transmission, data and fax are in, telex is out. Telex "is old-fashioned," says Johnsen. So are many of the concerns of earlier ships' radio operators. With the advent of satellite communications, the location of the radio room has ceased to be a consideration on board a ship. Transmission line length is no longer the concern it used to be.

Space limitations and the complexity of modern communications equipment make it impractical for the crew to service the equipment. In addition, with only two radio officers on duty, there simply isn't the time to do anything beyond minor repairs. Down time is minimized by duplicate equipment. If necessary, a service engineer can be flown out.

For men like Terje Johnsen who started his



**Even a chief radio officer needs some rest and relaxation. What better way than to listen to shortwave broadcasts! Shown here is Chief Radio Officer Terje Johnsen with his Grundig Satellit 500.**

career in the days of Morse code, the days of the simple radio room are gone. As the Radio Room on the *M/S Majesty of the Seas* testifies, we are embarking on a new era in which the radio room will be replaced with what Johnsen calls "a communications center."

The ship's bridge is located next to the radio room. The bridge itself is an array of communications equipment which ranges from handheld transceivers to a 2182 kHz watchkeeping receiver to radio direction-finding equipment to a GPS system. The radar system (there are three of them plus a backup system) looks like it belongs on the *USS Enterprise*. A touch screen displays and numbers "targets." The equipment will calculate speed, direction and time to collision. Although with radar that can work out to 125 km (80 miles) collision seems like a remote possibility. In fact, the radar is normally set to a distance of 30 km (20 miles).

It's not only the ship that is well-equipped. The lifeboats are equipped with VHF handhelds; two of them have VHF transceivers. And in the event of an emergency, the last officer off the bridge takes VHF equipment to communicate with search and rescue aircraft.

If the crew of the *RMS Titanic* had even a fraction of the equipment and technology that is now available, the events of April 14-15, 1912, would never have happened. The *Titanic* would simply have sailed into history as another ship in the White Star Line's fleet. The *Titanic's* wireless operators — Jack Philips and Harold Bride — might well have had long, relatively uneventful careers at sea working for their employer, The Marconi Company.

**TABLE I**

A partial list of stations heard from aboard the *M/S Majesty of the Seas* near Cozumel, Mexico. The last two stations were heard about midday.

Callsign	Frequency (kHz)	Location
KTRH	740	Houston, TX
WSB	750	Atlanta, GA
YNALN	620	Managua, Nicaragua
KKBQ	790	Houston, TX
WCBS	880	New York, NY
WOAI	1200	San Antonio, TX
WSMB	1350	New Orleans, LA
WSUN	620	St. Petersburg, FL
KMOX	1120	St. Louis, MO
WHNV	570	St. Petersburg, FL
ZNS1	1540	Nassau, Bahamas

# LORAN-C, a Low Frequency Radionavigation System

By Albert Lozano, AXL17@psu.edu

In the eons before radio, the maritime navigator relied upon the stars to calculate his position in a featureless ocean. But the stars were no help to the early aviator who had to fly in the daytime and find his fix from the lay of the land. A giant step for both services was the development of the LORAN (Long Range Navigation) system, based on radioelectrical signals operating in the low frequency band.

The predecessor of LORAN-C, LORAN-A, was first proposed in 1937 and fully developed in 1942 in Great Britain as an aid to assist bomber navigation in World War II. LORAN-A worked at frequencies between 30 MHz and 80 MHz, which limited its operation to nearly line-of-sight but it still serves its purpose.

Using a screen on the radio receiver, the navigator in the airplane measured the time difference between reception of signals from two pairs of terrestrial transmitter stations. From a chart that contained the estimated time differences from the stations, the navigator was able to determine the aircraft's position on a map. Today there are still a few LORAN-A stations from the World War II era in China and Japan used

by local fishermen. The last occidental LORAN-A system was decommissioned before 1980.

The new system, LORAN-C, was developed to provide the Department of Defense with radionavigation capability with longer range than LORAN-A by selecting the fre-

quency 100 kHz in the low frequency (LF) band. Today, there is little military use of LORAN-C, although it is still widely used for civilian navigation. In the United States, LORAN-C stations are operated and maintained

under the Coast Guard's mission of providing quality navigation services. Although the system was developed as an aid to navigation in the coastal waters, it was later expanded to include both full continental US coverage as well as most of Alaska. As reported in the 1996 Federal Radionavigation Plan, the 675,000 estimated users of LORAN-C are divided between marine users (82%), civil aviation for en route navigation using Visual Flight Rules and standard non-precision approaches to some airfields (14%), and civil land mobile (3.8%), while the rest are other users, including the Department of Defense.

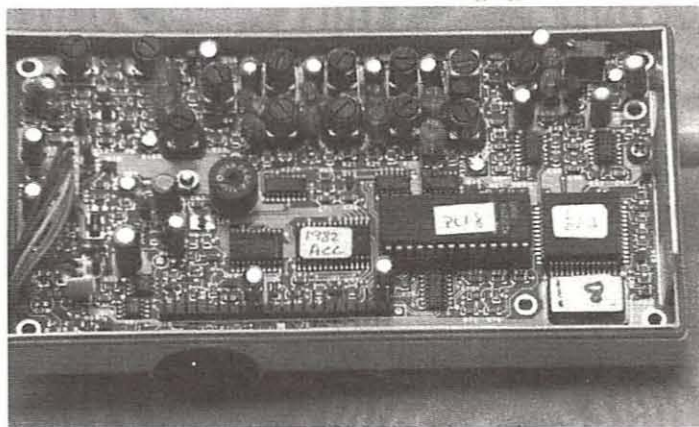
## ■ How does LORAN-C work?

The LORAN-C receiver determines its position by comparing the difference in delay between simultaneous radio transmissions from transmitters in several different locations.

The Lines of Position (LOP) are those points on Earth that have the same time difference in receiving signals from two different transmitters — the Master Station and one of the Secondary Stations. In Figure 1, the LOP between the Master and the First Secondary are plotted as



A close-up of the Ray Jefferson, PL-99 LORAN-C receiver. Notice the different options for display: long/lat, time differences, route, waypoints, etc.



Interior of the Ray Jefferson LORAN-C receiver. The section in the upper part of the picture contains the RF module (notice the inductors and coils), while the lower part contains the digital microprocessor and the crystal oscillator).

continuous lines, while the LOP between the Master and the Second Secondary are plotted using dotted lines.

From the illustration, we can see how plotting the LOP on a surface results in hyperbolic figures; the LORAN system is therefore known as a hyperbolic navigation system. Since each LOP is determined by a Master and a Secondary Station, we need one Master and two Secondary stations to find a position. In practice, the LORAN-C receivers normally decode more than two LOPs, which increases the reliability of the system and eliminates false readings.

The first LORAN receivers displayed only the Time Differences (TD) between the Master and each one of the Secondaries. The navigator then had to translate these TD into longitude/latitude using tables published and updated by the USCG. Today, these tables are still printed, although most of the modern receivers display position as longitude/latitude in addition to TD.

The group of a Master Station and its associated Secondary stations (two or more) is called a LORAN Chain. Within the US and Canada there are currently 28 LORAN-C Sta-

tions that make up ten LORAN-C Chains, as shown in Figure 2 (p. 23).

Each station is identified by its GRI (Group Repetition Interval) number. The GRI is the unique signature of a LORAN chain that differentiates it from all others. Instead of tuning into a beacon or a specific frequency, the receiver looks for signals with a specific interval or pulse repetition. The GRI is the time between the start of the master transmission, the series of secondary transmissions, and the next master transmission. GRI numbers are

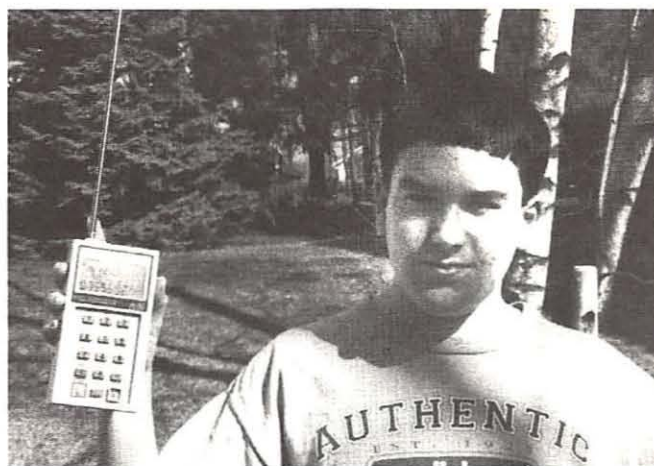
measured in microseconds (one millionth of a second).

Navigators using the LORAN-C systems must select the GRI that covers their area and change the GRI when entering another area. This is a major difference from navigation using the GPS satellite constellation. It's also important to note that the same station can act as a Master for one Chain and a Secondary for another Chain. This permits a larger number of active stations without the associated costs of building more transmitters and leasing the land.

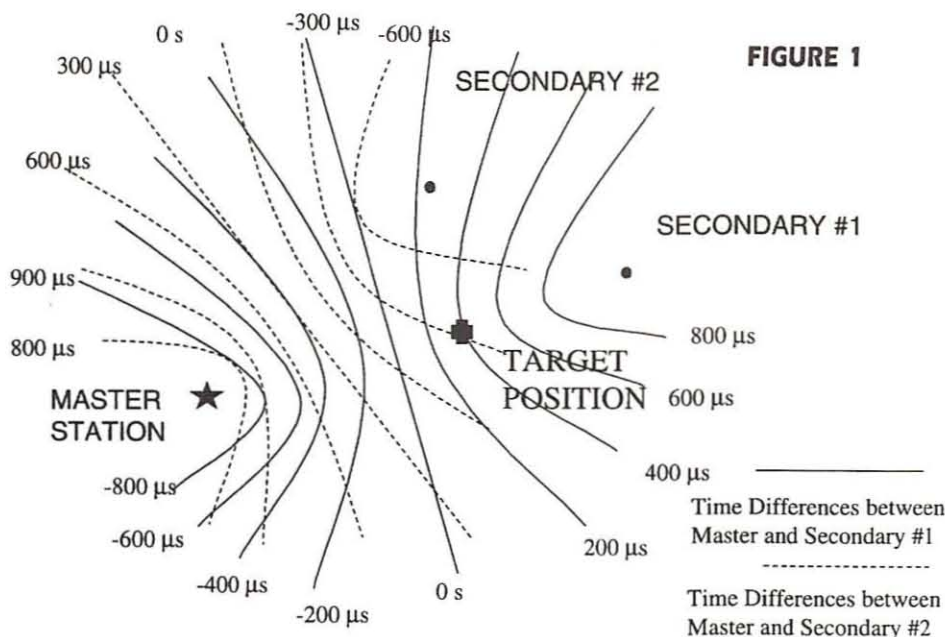
This sharing between chains is possible because of the synchronization between all the stations,

which is the responsibility of the National Institutes of Standards and Technology (NIST). But, if all the stations transmit on the same frequency of 100 kHz, how can the receivers detect the different stations to determine the LOP?

The answer to this question relies on the concept of time sharing. It would be really impossible to differentiate between stations if all of them transmitted simultaneously. But



*Author's son with the LORAN-C receiver. Once the user holds the metal plate on the back of the receiver, a dipole antenna is formed. The receiver's own antenna is half of the dipole, while the body of the user makes the other half.*



*Determination of position used by LORAN-C. Each straight line represents positions on Earth with the same Time Differences (TD) between the Master Station and the Secondary #1. The dotted lines represent the TD between the Master Station and the Secondary #2. The LORAN-C receiver measures the delay between the Master Station and both Secondary Stations and finds its position as the point where two TD intersect each other.*

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the stations are arranged to transmit in a specific sequence of pulses, with very precisely defined time delays between the transmitters. The receivers have this information built-in, so when the user selects a GRI, the receiver knows the pulse repetition rate for all the stations involved in the GRI.

### ■ What is the coverage of a LORAN chain?

The coverage of a particular station is a combination of the location of the station, the distance between the Master and each Secondary station, the transmitted power and other geographical characteristics. The Master and Secondary stations have been selected to cover most of the continental and coastal US and Alaska, with power values ranging from 200 kW to 2 MW.

Because the LORAN signal is in the low frequency band, most of the propagation is by groundwave, although skywave propagation sometimes occurs. This effect, though greatly enjoyed by LF beacon DXers, results in an interfering signal for those relying on radionavigation. Since skywave propagation is not stable but changes constantly, it is impossible to predict the arrival times for skywaves, and, consequently, no expected time differences can be predicted for a given position on the map. Other factors such as atmospheric conditions, terrain moisture and temperature, nocturnal to diurnal variability, and extreme weather like Alberta Clippers also affect the coverage and accuracy of LORAN-C, especially for aviation and land mobile users.

When talking about accuracy of navigational aids, we need to look at two basic types of accuracy:

- Predictable accuracy (also known as abso-



*An Apelco DXL 6000 LORAN-C receiver designed to be installed in recreational boats. Here it displays time differences instead of long/lat.*

lute of geodetic accuracy) is the accuracy of a position with respect to the geographic or geodetic coordinates on the Earth. For LORAN-C system, it ranges from 0.1 to 0.25 nautical miles (nm).

- Repeatable accuracy is used when the navigator wants to return to a position whose coordinates were measured previously using the same navigational system (for example, returning to that place where we like to fish). Repeatable accuracy using LORAN-C varies from 60 to 300 feet.

### ■ What is today's status of LORAN-C?

The 1996 Federal Radionavigation Plan has projected the use of LORAN-C as a navigation system for civil marine use in the US coastal waters until its planned obsolescence at the end of the year 2000. However, this service termination is currently being reevaluated and it is expected that the life of the

system will be extended past this date. Most of the LORAN-C users oppose the termination of the system (see the opinions expressed in the Web pages of organizations that use LORAN-C).

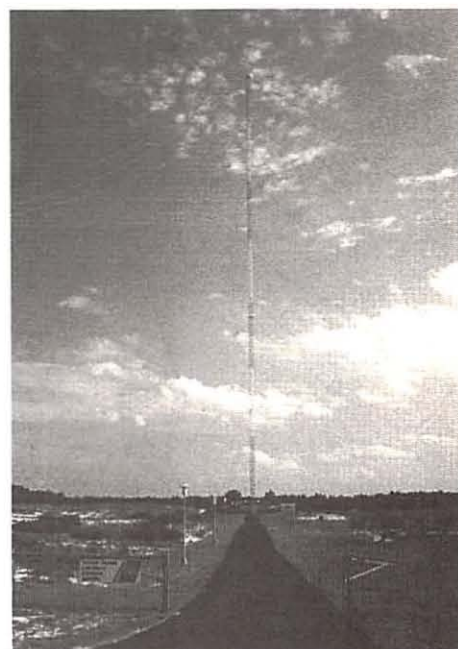
It is also important to note that there are 20 LORAN-C chains currently providing radionavigation outside the US and Canada, with newer stations being built in Europe in Japan, where LORAN-C and GPS are tools to complement each other. The availability of the system (the percentage of time that you are able to use the system) is better than 99.7%. That is slightly lower than the availability of GPS, but it is still very good. Although some past users of LORAN-C are moving towards navigational aides based on GPS (Global Positioning Systems) satellites, not all users have the economic capability yet to migrate to GPS.

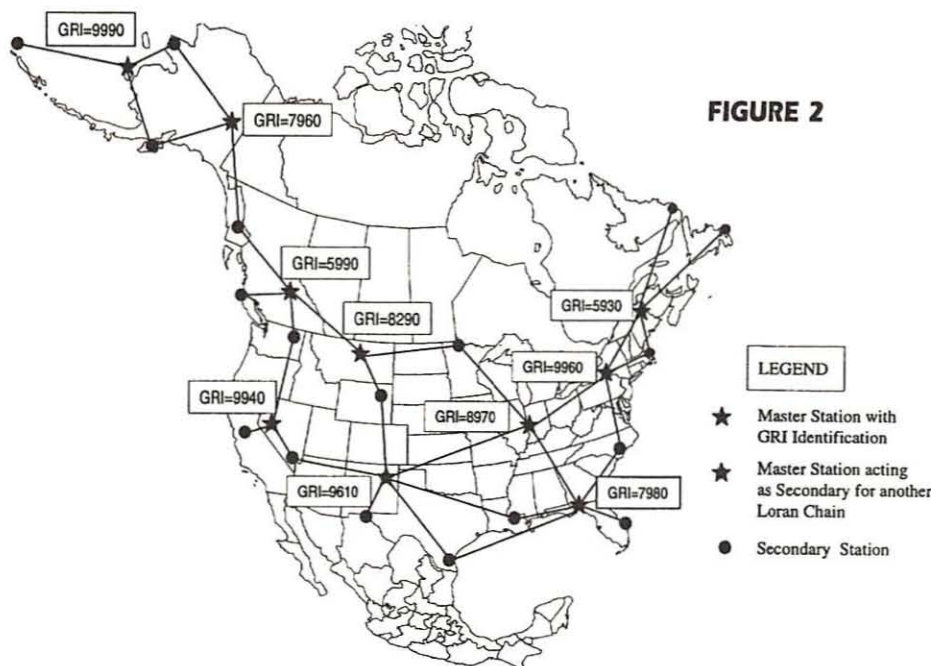
For those of you that like to experiment with different radio equipment, this is an excellent time to play with LORAN-C receivers. As many boaters move from LORAN-C to GPS, it is possible to find excellent units for a fraction of their original price. These units are normally found in excellent working condition; being a navigation aide, they have received good treatment and show an accuracy comparable to that of GPS.

My favorite LORAN-C receiver is the portable receiver shown in the pictures; it makes a great and inexpensive way to locate one's position. In the unlikely case that the LORAN service is discontinued, you still have acquired an excellent LF receiver for further experimentation.



*The LORAN-C secondary station in Jupiter, Florida (photos by Robert Wyman).*





**LORAN-C stations in the US and Canada. The locations of these stations has been chosen to cover the continental US, its coastal waters and lakes, and Alaska. Notice how in most cases, the same station acts as a Master for a LORAN-C Chain and Secondary for another Chain.**

## LORAN-C links on the WWW

<http://www.navcen.uscg.mil/>  
US Coast Guard Navigation Center

This site describes the different radionavigation services provided and maintained by the USCG. A good overview of these services.

<http://www.navcen.uscg.mil/loran/lgeninfo/h-book/h-book.htm>  
USCG Loran User's Handbook

The LORAN-C User's Handbook is probably the most extensive reference on LORAN-C available to the general public. In this site, there are directions how to order the Handbook, or to download on line (free of charge, but without figures and graphs).

<http://www.lsu.uscg.mil/>  
United States Coast Guard Loran Support Unit  
Homepage of the specific command of the USCG on LORAN-C

<http://www.sec.noaa.gov/nav/loran.html>  
LORAN page of NOAA (National Oceanic and Atmospheric Administration)

<http://www.illgen.com/ila/>  
International LORAN Association  
The International Loran Association (ILA) consists of organizations and individuals who advocate the continued implementation and use of the Long Range radio Navigation system Loran-C throughout the world.

<http://home.sol.no/~loranc/>  
LORAN Control Center B0  
Homepage of the North European LORAN-C Station and control center

<http://www.megapulse.com/>  
Megapulse Inc.  
Homepage of one of the biggest manufacturers of LORAN-C transmitters. Excellent information, unique pictures of transmitters and maps of international LORAN-C coverage.

<ftp://bb.iu.net/pub/jb>  
FTP site with multiple articles on radionavigation

<http://www.avionix.com/loran.html>  
Eastern Avionics International, Inc.  
LORAN-C systems designed for civil aero navigation.

If you are interested on purchasing one of these units and live close to the coast, start your enquiries at the marinas; most boat owners that have switched to GPS don't know what to do with the units they replaced. If, like me, you live in the interior of the US, look in the different Web auction services and other places that trade used equipment. Don't just look in the trade sections for radio receivers, but also scour the sections on fishing.

To borrow a phrase, "Wherever you go, there you are!" and with LORAN-C, you'll know just where that is.

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# Ham Radio: Safe Bet For Boaters

By Arthur R. Lee WF6P

One of the most fun-filled trips I ever made in a small sailboat was a passage between two islands about fifty long ocean miles apart. There were three boats making the trip, and we were all good friends. As the boats were not equipped with the luxury (and expense) of electronics, one of the skippers managed to obtain three low-powered, commercial-band, "hand-held" radios and plenty of spare batteries. This provided us with some measure of security in case one of the boats got into serious trouble. In the open sea, especially at night, this was a far better and more practical method of communicating between boats than the old arm waving, flashlight flashing or trying to scream above the 30 knots of wind usually encountered in those waters.

After three days and two nights of communicating via radio, I was a total convert from the safety standpoint. More than that, it was fun! Imagine being alone in the cockpit in the wee hours of the mid-watch on the full moon bathed ocean, sipping hot coffee and talking in hushed-tones to the solitary helmsperson in each of the other boats.

Well, that was a long time ago, and today I would not venture out of port any distance without adequate communications. Today, as required by the Coast Guard, my first radio would be a marine VHF (very high frequency) radio. Secondly, I would have two kinds of ham radio aboard: HF (high frequency or shortwave) and 2 meter (VHF) equipment. Each has its place in communications. Let's examine them both.

## ■ Equipment

First, HF equipment: This is your basic amateur radio, used for short and long range communications by hams afloat and ashore. Today's "rig" is small, compact, reliable and packs a big signal, usually 100 watts output. With it you can talk to friends on the next dock or at anchor in San Francisco, La Pas or Tahiti. Friends of mine have cruised extensively over Pacific waters for years with today's highly reliable equipment without failure.

Several popular rigs, the Kenwood TS-440S, ICOM IC-735 or Yaesu FT757 are commonly used. The cost is about the same for each, in the range of \$1200 from mail order houses. Antennas and tuners are extra. Which rig is best? It seems that everyone swears by the one they own, but I have owned and

operated them all and cannot see much difference. As is usually the case, the choice of rig boils down to a personal preference.

The new 2 meter rigs, either hand-held or portable, are highly useful in communicating from boat-to-boat or boat-to-shore. Generally, 2 meters is used for short range, line-of-sight work, but through the use of shorebound repeaters, the range is extended up to 300 miles or longer, depending upon a number of variables. Most coastal towns have at least one repeater; major cities such as Los Angeles or San Diego have dozens. A list of repeaters is available in a small but handy directory available at most ham equipment stores (and Grove Enterprises).

## ■ Nets and Patches

A tremendous advantage with 2 meters is the use of repeater autopatches — telephone devices that permit you to make direct, no-cost calls from your boat to friends ashore. Hams, being the friendly group that they are, gladly "bring up the autopatch" for on-the-air visitors when asked (local calls only). The receiving party does not have to be a ham.

If you belong to a ham club with its own repeater, unlimited phone patches can be made. Recently, my friend amateur radio operator N6NUN and I anchored his trawler off a coastal town. As we rowed ashore in the inflatable dinghy, he called his wife at home via autopatch and she rendezvoused with us in a local restaurant for lunch.

When out sailing I often call my wife on 2 meters (she is amateur radio operator KJ6PB) to tell her when we will be docking. If we anchor out overnight or stay in a distant marina, long chats via ham radio with family at home are comforting and fun.

On HF, another big advantage to boaters are the Maritime Mobile Nets. These nets are set up on several different times and frequencies and are controlled and operated by dedicated ham operators. Most of the operators are boaters, former boaters, or people with long associations with the sea (ex-military, commercial radio officers, aircraft pilots, etc.). With them they bring a wealth of knowledge, experience, and — of most importance — the ability and desire to help sailors at sea.

Communications between boaters and maritime mobile nets have resulted in the saving of lives as well as the passing of essential and non-essential information. Medical

emergencies are relatively common, with direct contact often made with private physicians and hospitals by net controllers. Most notable is the spirit of camaraderie on these nets. After years of working together, net controllers and net relay operators know each other by first name and call sign.

When a skipper initially checks in with the nets, valuable boat and crew information is recorded and often maintained on computer discs. Frequently, when atmospheric conditions permit, crews of cruising boats are able to get phone patches into the USA to talk to families. I once ran phone patches every few days for a cruising sailboat in transit from the Galapagos to the Marquesas. The delivery skipper was able to talk to his wife and son in my town on nearly every contact.

## ■ Getting on the Air

So, how do you get to enjoy the friendly communications available through ham radio? First, you must obtain an operator's license through the Federal Communications Commission (FCC), as only licensed operators can use ham frequencies. Obtaining a license has become quite simple and is getting easier every year.

For the past several years, the question and answer pools have been in the public domain and are available from many sources, including Radio Shack stores. There are several ham courses available by mail with many on computer disks and video tapes. Be sure the course you study is up to date with the latest question pool.

A widely-used and popular Novice/Technician course is *Now You're Talking*, available from the American Radio Relay League, 225 Main Street, Newington, CT 06111 for less than \$20; code practice tapes are about \$10.

If self-study is not easy for you, many local ham clubs, high schools or community colleges hold ham classes. Ask the ARRL for a list of classes in your area or contact your local library or newspaper for information.

Tests are given by volunteer examiners in most major cities. A letter or telephone call to the ARRL (1-860-594-0200) will give you information on testing times and places.

When on a long passage, a day sail or locked in port when the rain blows and the hatches are all battened down, ham radio can be a lot of fun and add to your safety and boating pleasure.

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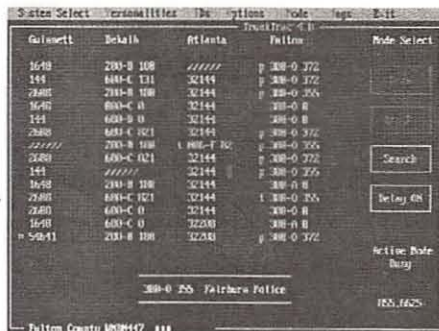


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### Incident Scanning

There's nothing that makes scanning more exciting than monitoring during a major incident. It could be a snowstorm, forest fire, or huge sporting event. While a sustained incident is fascinating simply because it offers more time to scan, a brief but intense event, such as a car chase, can be the most enthralling of all. This goes to the issue of "Why we scan" which I posed in a recent issue.

Brian Cathcart, known on the Trunkcom List Server (learn how to subscribe at [www.trunktracker.com](http://www.trunktracker.com)) as "The Scanner Dude," wrote a fine piece on his scanning experience during a recent aircraft incident at the Miami airport. We liked this story because it not only demonstrated how to scan during a major incident, but also there were also no serious injuries or deaths that resulted from the situation. Finally, it raised an interesting trunk-tracking question. Here, then, is Brian's report:

"Turned on the 895XLT as I was wrapping up my computers, and ID 12400 (Airport operations) came active with an Alert 3 (fire) of a 727 with an engine on fire. I switched another scanner to 119.3 (Tower) and heard them say to switch to 121.4 (ground). Heard 186 people on board, initial reports said number one engine on fire, and was still on fire as plane came to a stop.

"Broward County Fire-Rescue and Fort Lauderdale Fire Rescue responded with several units and were told to use channel 14K (18064), but after hearing no activity I hit the search button and found them on ID 1043 (channel 110 crosspatched).

"Runway 9L temporarily shut down, planes using other runways. All people successfully evacuated on slides, so far five people hurt, mostly ankle injuries. Buses called in to pick up passengers on runway, Broward Sheriff's Office (BSO) called in to make sure no one goes into plane. Turns out to be engine #2 that burned; units completed secondary search with 'all clear.' Level 2 MCI (Mass Casualty Incident) in full progress!, at 9:55pm rescue units still being called in."

#### Talkgroups in use (Broward County system, type 2)

1043	Main operations cross-patch
4592	Broward Sheriff Office operations at the airport, crowd control, guarding 727
4752	Secondary of 4592
8208	Broward County Fire Rescue (BCFR) North channel
8272	BCFR South channel
8368	BCFR "ECHO" of 8208
8432	BCFR "ECHO" of 8272
8496	BCFR TAC A
8528	BCFR TAC B
8560	BCFR TAC C
9040	MED-COM MED 10 establishing encodes to hospitals
9200	BCFR "ECHO" of 9232
9232	BCFR West channel
12400	Airport operations, coordinating gates and buses
18000	channel 14 India, medical sector

#### BROWARD COUNTY FIRE-RESCUE CENTRAL

(County central units and Fort Lauderdale fire-rescue) on Fort Lauderdale's trunked system

Joint Operations (system 14 in Broward SO and Broward County fire-rescue radios):

17616	14 Alpha-Calling channel
17648	14 Bravo-Fire calling channel
17680	14 Charlie-Police calling channel
17712	14 Delta-Car to Car 1
17744	14 Echo-Car to Car 2
17776	14 Foxtrot-Joint/Special Operations 1
17808	14 Golf-Joint/Special Operations 2
17840	14 Hotel-Joint/Special Operations 3
18000	14 India-Joint/Special Operations 4
18032	14 Juliett-Joint/Special Operations 5
18064	14 Kilo-Joint/Special Operations 6

Frequencies (\* denotes control channel/\*\* denoted phone patch):

860.2375*	860.4875*	860.7375*	860.9875*	852.7125	852.7375
852.8125	855.2375**	855.7375**	856.4875	856.7375	857.3625
857.4875	857.7375	857.9875	858.3625	858.4875	858.7375
858.9875	859.3625	859.4875	859.7125	859.7375	859.9875

I queried Brian on one interesting aspect of his report. Here's Brian's response (which also generated quite a bit of discussion on Trunkcom):

"I don't know why the crosspatch was on 1043. When the call went out on Broward County Fire-Rescue's South channel (8272), they told all responding units to switch to channel 14K (18064). But after hearing no activity on it (or the rest of the 14x channels), I suspected they were on another ID, so I hit the search button, and they popped up on 1043. This is a cross-patch of 1040, but why these units even showed up on 1043 (after they said switch to 18064) I don't know. There was no activity on the 'standard ID' of 1040.

"As for the Trunk Tracker, it performed flawlessly!! I was able to hear everything from start to finish! It would have been very difficult (if not impossible) to listen to this with a non-trunking scanner.

"Now about that status nibble, a question: When several talkgroups are patched together, would they show up on an ID that is totally non-standard? In other words, if all the units were on 18064, but crosspatched to other ID's, is it possible they would show up on 1043 instead of 18067 (plus 3) or 18071 (plus 7)? I'm just trying to figure out why they ended up on 1043 when they said they were switching to channel 18064 (channel 14K)."

We're not sure of the answer to this question. Lindsay Blanton suggested that the dispatcher may have dynamically regrouped the units onto this ID in order to set up an incident command channel among certain units on-scene. This seems odd as there usually are such specialized channels already available.

Here's the information we have on how a normal talkgroup can be modified with a bit change in the data structure to allow for unique, special-purpose, channelization:

ID+0	Normal talkgroup
ID+1	All Talk Group (a Type II fleetwide mode)
ID+2	Emergency talkgroup
ID+3	Crosspatched talkgroup (two talkgroups together)
ID+4	Emergency talkgroup
ID+5	Emergency Multi-select
ID+7	Multi-select (initiated by the dispatcher)
ID+8	Digital encryption
ID+9	All Talk Group with digital encryption
ID+10	Emergency talkgroup with encryption
ID+11	Crosspatched talkgroup with encryption
ID+12	Emergency crosspatch with encryption
ID+13	Emergency multi-select with encryption
ID+15	Emergency multi-select with encryption

You can find these talkgroups (although they are not normally active) by using the Search function of your TrunkTracker or by programming them directly into memory. Remember, though, it usually is not necessary to enter cross-patched talkgroups as they'll only duplicate what you hear on other groups.

### ■ Summertime Scanning

The El Niño winter of '97-'98 was not a very white one for most of the U.S. and the scannists of America lost out on most of their annual snowstorm monitoring fun. But, with the advent of warm weather this time of year we can tune into those summertime monitoring hotspots:

- Marine radio/Coast Guard
- State and federal forest service/park management channels (be sure to listen to the fire towers)
- County fire networks (which often coordinate with the state and federal agencies)
- City police departments which really cook on summer nights
- Beach/resort public safety channels

Summer is a great time for scanning. Take your portable to ball games, the beach, and around town. When you're at home at night check out the city police forces. Be sure to also check out the common summertime conditions of ducting and skip where you can hear departments from the other end of the state or the other end of the country! Also be sure to use some spare time to consider upgrading your antennas and coax.

### ■ Another New Player in the Scanner Market

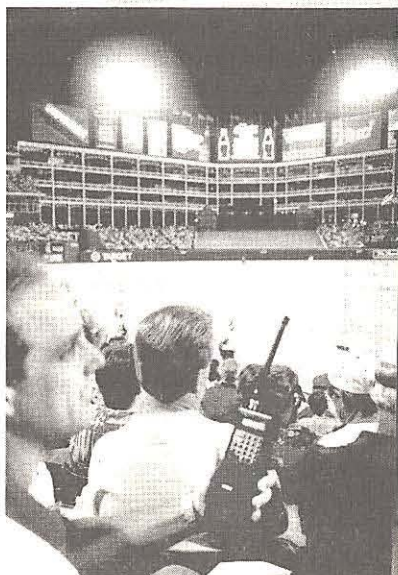
Word on the street is that Sony (yes, Sony!) will have introduced their new

portable scanner by the time this article is published. This is astounding news. While the scanner market has declined, consumer electronics firms continue to enter this niche industry. In the last 18 months or so, we've seen RELM, RCA, Alinco and now Sony enter (or re-enter) the business.

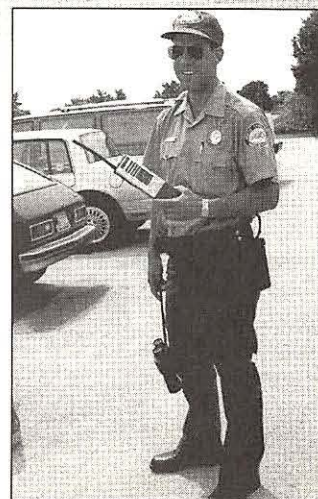
If there ever was fodder for a Harvard Business School case study, this would be it. Do these companies believe that Uniden and/or Radio Shack have dropped the ball in the marketplace? Do they feel that there are new channels for distribution and new customers that can be enticed into the hobby?

On the next page are some of the specs for the Sony scanner. A couple of the items which jump out at us include computer control of a portable (something which has been around for a long time on the AOR-8000), Service Search (up until now a feature pretty much, but not entirely, unique to Uniden scanners) with TV search (excellent idea), and the CD-ROM included for programming.

These are all nice touches, but are they enough to steal significant market share away from the two majors? With the Sony name, and likely hot new styling, yes, it's possible. Without something revolutionary, such as trunking and digital, this editor does not see it as likely. What we hope will happen is that Sony, with its broad reach and



*Summertime, and the scanning is easy.  
(Photos by Harry Baughn)*



appeal, will find new customers for its scanners rather than existing scanner users. That would be good for the entire industry.

## The Sony ICF-SC1PC Scanning Receiver

- Bi-Directional PC Interface with search and control capabilities
- Use CD-ROM with PC interface to search frequencies and to create files using a variety of search mode options
- Scans all frequencies allowed by the FCC from 25 MHz to 1300 MHz (with the exception of cellular bands)
- PLL synthesized scanning
- 300 channel memory
- One-button access to police, air, fire/emergency, weather, marine, FM and TV
- Intelligent active memory system
- Variety of programmable features
- AM and narrow/wide FM reception
- Supplied frequency guidebook

## ■ Some Old-time Mail

In going through the back mail, I came across a letter from John Wallis of Aurora, Colorado. In responding to an article written over a year ago, John's letter was coincidentally quite relevant to recent questions we've posed regarding "Why we Scan." He also discuss some features he would like to see in a scanner.

"Dear Mr. Barnett:

In your column in the March 1997 edition of *Monitoring Times* you mentioned that you had not received very many replies on your question about what scanner had the most impact on the listening careers of your readers. This is, of course, a very difficult question to answer, since all of the scanners I have owned have had features that made them significant.

The Realistic PRO-34 that I've been using as my primary mobile scanner for about eight years probably qualifies the best of the title. It was the first keyboard-programmable scanner I ever had, and, with a few small repairs, has served me well over the years. The audio is lousy, but adding a powered external speaker has solved that problem. Choosing an antenna to match the listening situation helps eliminate most of the intermod problems.

A Realistic PRO-2006 is the mainstay at home (*as it is in many homes—ed.*), and is easily the best all-around scanner that I've ever had. The audio is great, it is easy to program, the attenuation switch lets you use it in the car without being overwhelmed by nearby sources, yet it is sensitive enough to use for those times when you can catch the East Coast on skip. The ability to search through ten frequency ranges of your choice makes it so versatile that I built a holder for it that sits on the floor of the car so I can take it on long trips with me. The fact that the frequency range also includes military aircraft makes it very nice for airshows, too. My only regret is that I didn't pick up a couple more of them when they were being sold off by Radio Shack and by Grove.

To introduce myself, I am 53 years old, grew up in Philadelphia, moved to the Denver area about 25 years ago, and have never regretted that move. I started listening to radio at about 10 years of age, first

listening to Broadcast Band DX, then shortwave, then scanners. My first VHF radio was a Radio Shack Patrolman-17, with a dial to tune in the stations, and no squelch. Over the years I have accumulated about a dozen scanners and VHF receivers, all of which are still working, although a few repairs have been necessary to keep them going.

I have been doing field service work on large commercial fire alarm systems for about 23 years, and this is one of the reasons I have remained so active in scanning. When you are constantly on the road, both in the city and in rural areas, you really need to keep track of what's happening. I can't begin to count the number of times that my scanner has saved me from using a road that was blocked by traffic, or by an accident, or even a police incident, such as felony arrest. One of the most valuable services that my scanner provides is letting me know when emergency equipment is coming my way so I can get out of the way for them. There is also the entertainment value of a scanner around town or on a long trip.

Anyone who has used a scanner for a lot of years can look back on things they have heard and see how much he would have missed without it. I have heard airplane hijackers giving their demands to the authorities, airplane crashes from the perspective of being in the cockpit. You also hear things that are funny to you, but not to the person involved, like the lady who had her finger impaled on a fish hook which was hooked on the inside of a dog's mouth. The dispatcher told the fire trucks to shut down their sirens five or six blocks before their arrival.

You also asked for features that we would like to see included in future scanners. It just so happens that I have given that some thought.

A remote control. I usually am not sitting in the same place in my living room as my scanner. Sometimes I want to turn up the volume from across the room. (*Icom has this feature on their top-of-the-line base models.*)

Flexible bank sizes. I have my scanner programmed by county, since I pass from one county to another quite frequently in the course of a work day. Some counties are much larger than others and some are very small. (*This is a great idea, and one that many have brought up in the past, but we have queried the software engineers on this matter and they tell us it is actually quite difficult to implement—ed.*)

Ability to scan designated channels when desired. When an emergency happens that requires using channels in different banks, it is difficult to lock out all of the other channels. Why not have the ability to go to the channels you need, click on some kind of designator, and scan only those channels? This would be a lot less complicated at a very stressful time. (*This feature does exist on many Icom scanners. It is known as Select Scan—ed.*)

Some features that are available on a variety of scanners, but not all on one single scanner: The ability to link search ranges together; a lockout review switch; search lockouts. Also, an antenna switch. Two antenna inputs would be nice. (I can dream, can't I?) And, of course, the ability to follow ANY brand of trunked radio system."

All fine ideas, John. Let's hope the manufacturers take these and other ideas we've passed on into consideration. Next month we'll revisit the issue of feature overkill on scanners. The recent article in which we trashed the Send key and other unnecessary functions caused quite an uproar. At least we got you talking! Next month we'll hear what you had to say.

# Bearcat Intercepts Trunked Radio

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## Radio Transceivers

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Your RELM radio transceiver is ideal for many different applications since it can be programmed with just a screwdriver and programming instructions in less than ten minutes. Programming is even faster with the optional PC kit. The technician programming instructions part #PIMPV is \$18.00.

## TrunkTracking Radios

### Bearcat®235XLT-A TrunkTracker

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The Bearcat TrunkTracker BC235XLT, is the world's first scanner capable of tracking a selected radio transmission as it moves across a trunked radio system. Now it's easy to monitor fleets and subfleets in analog trunked radio systems. The BC235XLT can also work as a conventional scanner. This 300-channel, programmable handheld scanner provides scanner users with uninterrupted monitoring capabilities of Type I, II, III and hybrid trunking systems. One of the biggest obstacles in the scanner industry has been the increasing use of trunking radio systems in business and public service agencies throughout the U.S. and Canada. This makes it nearly impossible to track a conversation as it moves within a trunk system from frequency to frequency. According to Ken Ascher, WB8LIT, Chairman & CEO of CEI, "the Bearcat 235XLT is a revolutionary breakthrough in scanner technology. Now it's easy to continuously monitor conversations even though the message is switching frequencies." The BC235XLT comes with AC adapter, CRX120 battery charger, two rechargeable long life ni-cad battery packs, belt clip, flexible rubber antenna, earphone, owner's manual and one year limited Uniden warranty. Not compatible with AGEIS, ASTRO, EDACS, ESAS and LTR systems. Call 1-800-USA-SCAN to order your scanner.

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## Radio Scanners

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300 Channels • 10 banks • Built-in CTCSS • S Meter

Size: 10-1/2" Wide x 7-1/2" Deep x 3-3/8" High

Frequency Coverage: 29,000-54,000 MHz., 108.000-174 MHz.,  
216.000-512.000 MHz., 806.000-823.995 MHz., 849.0125-868.995 MHz., 894.0125-956.000 MHz.

The Bearcat 895XLT is superb for intercepting trunked communications transmissions (see BC235XLT description) with features like TurboScan™ to search VHF channels at 100 steps per second. This base and mobile scanner is also ideal for intelligence professionals because it has a Signal Strength Meter, RS232C Port to allow computer control of your scanner via optional hardware and 30 trunking channel indicator annunciators to show you real-time trunking activity for an entire trunking system. Other features include Auto Store - Automatically stores all active frequencies within the specified bank(s). Auto Recording - This feature lets you record channel activity from the scanner onto a tape recorder. CTCSS Tone Board (Continuous Tone Control Squelch System) which allows the squelch to be broken during scanning only when a correct CTCSS tone is received. For maximum scanning enjoyment, order the following optional accessories: PS001 Cigarette lighter power cord for temporary operation from your vehicle's cigarette lighter \$14.95; PS002 DC power cord - enables permanent operation from your vehicle's fuse box \$14.95; MB001 Mobile mounting bracket \$14.95; EX711 External speaker with mounting bracket & 10 feet of cable with plug attached \$19.95. Comes with AC adapter, telescopic antenna, owner's manual and one year limited Uniden warranty.

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# Unraveling NATO Identifiers

Utility listening is detective work. Transmissions, which can come from just about anywhere, go to specific users. They're in on it. We're not. We need to use subtle propagation effects, traffic, a callsign, or some other identifier to tell us who they are. This month, we'll look at how NATO, the North Atlantic Treaty Organization alliance, does its identifiers.

## Broadcast Designators

When I was new at this, I often wondered who "C13E" was. It was used by CKN, a Canadian Forces naval station, in a powerful, CW marker that could blister paint on a good night. It's off the air now, which is too bad, because the whole loop was one of those nice, Morse rhythms that almost made one get up and dance.

C13E turned out to be a special Naval Broadcast Designator. This is an old system used by NATO CW/FAX/digital stations when broadcasting operational orders or traffic to assets in the field, usually ships at sea, who might not want to give away their position by "rogering" the traffic.

C13E, therefore, breaks down as per the standard, 3- or 4-character code. The first is a letter, for the member nation or agency — in this case "C" for Canada. Second, a number, is the broadcast area, "1" being any large ocean region. Third, a number, is the broadcast type, "3" being Morse telegraphy. The last one or two letters identify the specific station. In this case, it was Esquimalt, a coastal city near Victoria, BC.

Even though Morse is vanishing from the military airwaves, similar codes are still copied on RTTY. You might also, rarely, run

**TABLE 1: NATO Country Codes**

A	Australia	N	Netherlands
B	Britain	O	None at present
C	Canada	P	Portugal
D	Denmark	Q	Belgium
E	Spain	R	None at present
F	France	S	South Africa
G	Germany	T	Turkey
H	USA	U	USA
I	Italy	V	None at present
J	Argentina	W	None at present
K	Greece	X	NATO
L	Luxembourg	Y	Norway
M	SE Asia	Z	New Zealand

**TABLE 2**

## Naval Broadcast Designators

Figure	Content
1	Origin (see NATO Country Codes)
2	Broadcast Type:
1	Wide Area
2	Limited Area
3	Submarine
4	Special request - ops or exercises
3	Broadcast Mode:
1	Encrypted RTTY
2	Clear RTTY
3	CW
4	? Might be fax per Ary Boender
4	Station Suffix (optional)

across a pre-NATO one, such as NAWS (Notice to Allied War Ships).

## NATO Routing Indicators

Radio messages have always begun with header instructions for operators, and later for computers. In RTTY telex, and similar networks, these handling instructions contain strings of routing indicators (RIs).

Quite some time back, NATO published an RI standard for its own RTTY traffic. These differ from callsigns in that they're more flexible. They are four through nine characters long, and can comprehensively describe source, destination, and even suggested relay points or lists of units which need to see the traffic. The first one given is destination, and the second, with its traditional "DE" prosign, is the source. Newer communication terminals can parse these RIs for all sorts of information, routings, or format changes for other networks (like the U.S. AUTODIN).

On shortwave, most of the RIs you'll copy are French. Some countries, including the United States, barely use them, while others change them a bit. This is yet another of those interoperability issues that NATO communicators frequently bemoan.

Let's do some examples. In our April Utility Log, a couple of RIs were mistaken for callsigns. RFQP, on 13444 kHz RTTY, was Originally misidentified as a Russian embassy. Let's break down the RI and find out who it really was:

The first character, R, is for type of originating station — in this case strategic, like a base. Most RIs you'll see start with R, and this plus the position in the header (right after the

starting sequence and classification) is one way to spot them.

The second character, F, is the NATO country code (France), same as in the naval designators. The third character, Q, is the area of operation or responsibility, in this case the Middle East. The fourth is used by France (and basically France alone) for the type of asset: army, navy, air, or whatever. Other countries use it for different things. Any characters after the first four are additional, user-specific routing instructions.

So we already have quite a bit of information about this station. Sure enough, upon looking it up, we find a naval contingent in Djibouti on the East African coast.

Similarly, RFGW, which was given as Russian on 13953, is really French diplomatic in Paris. It's copied worldwide with traffic for embassies.

The RI system is obsolescent, and will probably give way, ultimately, to something more resembling the IP address numbers used on the Internet. This will give even more flexibility.

Ary Boender, of the Worldwide Utility Network, has compiled one of the better RI lists, shown in Table 1. It's on the World Wide Web, along with a lot more explanation than I can give here. Have fun with this stuff!

**Table 3**

## Alternate NATO Routing Indicators

Figure	Content
1	Station Type
P	Reserve tactical
Q	Reserve strategic
R	Strategic
U	Tactical
2	Origin (see NATO country codes)
3	Operation Area:
A	East Asia
C	Central NA
D	UK, Iceland
E	Eastern NA
F	Europe
H	C, S Pacific
K	Alaska
L	Caribbean/ SA
M	South East Asia
Q	Middle East
S	Western Asia
T	Iberia, NW Africa
V	Southern Africa
W	Western NA
X	NATO
Y	Australia
4	Asset Type (French), or user-specific
5-9	Specific unit, routing or recipient

### Abbreviations used in this column

75/150	RTTY speed/shift (varies)	GHFS	Global High Frequency System
AB	Air Base	MFA	Ministry of Foreign Affairs
AF	Air Force	NASA	National Aeronautics and Space Administration
AFB	Air Force Base	NORAD	North American Aerospace Defense Command
AM	Amplitude modulation	PACTOR	Teleprinter system combining characteristics of packet radio and SITOR
ANDVT	Advanced Narrowband Digital Voice Terminal	RAF	Royal Air Force (U.K.)
ARQ	Automatic Repeat Request (an RTTY mode)	RTTY	Radio Teletype
ARRS	Aerospace Rescue and Recovery Service	RY	RTTY test (from traditional RYRYRY...)
CG	Coast Guard	SAM	Special Air Mission (USAF VIPs)
CP	Command Post	SHARES	Shared Resources (US Government)
CQ	General call: Hello all stations	SITOR	Simplex Telex Over Radio
CW	Continuous Wave (Morse code)	Unid	Unidentified transmission
DoD	Department of Defense	USAF	U.S. Air Force
DSN	Defense Switched Network (formerly AUTOVON)	VIP	Very Important Person
EAM	Emergency Action Message	VNA	Vietnam News Agency
FEC	Forward Error Correction (an RTTY mode)	VOLMET	"Flying Weather" (from French)

All transmissions are USB (upper sideband) unless otherwise indicated. All frequencies are in kHz (kilohertz) and all times are UTC (Coordinated Universal Time).

- 657.0 Unid-North Korean female numbers, using powerful AM transmitter possibly from Radio Pyongyang, nightly at 1500. Similar, though not parallel, on 3250 and 6400. (Takashi Yamaguchi, Japan)
- 3116.0 Khabarovsk-Russian Volmet, weather at 1315. Irkutsk-same, at 1325. Both also on 8861. (Yamaguchi-Japan)
- 3454.0 HQH-Otherwise unid station with hand sent CW CQ, at 1215. Interfering with Tokyo Aeradio on 3455. (Yamaguchi-Japan) *I don't have a clue either. These guys pop up all over the aero bands. Could be spies, submarines, or just yo-yos practicing their code on-air.* -Hugh
- 4038.0 Unid-Italian military, tactical comm at 0004. (Ary Boender-Netherlands)
- 4048.0 NATO Strong Resolve exercise, tactical comms by various nationalities, at 0001. (Boender-Netherlands)
- 4086.0 At least 10 vessels with three-letter callsigns, in newscast for and by Philippine sailors, at 0011. (Boender-Netherlands) *Any clue on what this is?* -Hugh
- 4165.0 KPA 2- Mossad, Israel, AM numbers at 2114. (Boender-Netherlands)
- 4229.5 FUF-French Oceana, with RTTY test slip (75 baud), at 0323. (Sue Wilden-IN)
- 4426.0 USCG Portsmouth Radio, VA, voice-synthesized high seas weather, at 0347. (Wilden-IN) CAMSLANT Chesapeake working CG cutter *Venturous*, troubleshooting data circuit at 0542. (Glenn Finerman-NY)
- 4445.0 Possibly M4, with numbers in progress, ended with "372 372," CW at 1720. (Boender-Netherlands)
- 4455.0 FQJO-Russian?, calling PRNP for 15 minutes, in CW at 2343. (Boender-Netherlands)
- 4575.0 V-Russian Navy, Khiva, with CW channel marker at 1350 (Yamaguchi-Japan)
- 4663.0 Tashkent-Russian Volmet, weather at 1310. (Yamaguchi-Japan)
- 4665.0 MIW 2-Mossad, Israel, numbers at 2215. (Yamaguchi-Japan)
- 4721.0 Reach 947-USAF Air Mobility Command transport, radio check with Offutt at 0113. (Larry Fowler, NY) U9P-Italian Navy Roma, tactical comms at 1805. (Boender-Netherlands)
- 4877.0 Russian Navy Khiva, Uzbekistan, marker at 0006. (Boender-Netherlands)
- 4880.0 ULX 2-Mossad, Israel, numbers at 1630. (Yamaguchi-Japan). Same station, in AM at 2300. (Boender-Netherlands)
- 4987.0 9VDC-Unid, possibly Russian, calling J91L with repeating CW loop, at 1758. (Boender-Netherlands)
- 5091.0 JSR 2-Mossad, Israel, numbers, parallel 7540, at 1530. (Yamaguchi-Japan)
- 5154.0 F, K, E-All Russian Navy single letter CW markers, at 1515. F is Vladivostok, K is Khabarovsk, E is unknown. (Yamaguchi-Japan) /

- wonder if these are still being offset a few hundred Hz each-Hugh.
- 5230.0 CIO 2-Mossad, Israel, numbers, parallel 8465 and 10352, at 1545. (Yamaguchi-Japan)
- 5245.0 MRC 28-RAF Cadets, United Kingdom, several stations at 1100. (Boender-Netherlands)
- 5550.0 New York Radio-ARINC MWARA, working Reach Victor 9, American 55, enroute to San Juan at 0050. (Wilden-IN)
- 5598.0 NY Radio-ARINC MWARA, working Reach Victor 9, with flight levels, at 0331. (Wilden-IN)
- 5680.0 Unid exercise, with EAMs, from several stations using NATO trigraphs, at 2322. (Jeff Haverlah-Texas)
- 5696.0 USCG CAMSPAC Pt.Reyes, CA, setting up radio guard with CG 1602, 8983 secondary, 11202 tertiary, at 0138. (Fowler-NY) USCG CAMSLANT Chesapeake, VA, working Rescue 1716 and 1790, in rescue ops, and working 63 Alpha, mentioning Panther (DEA, Bahamas). (Ron Perron-MD)
- 5875.0 Nightwatch 01-USAF, working Override, setting Z155 (this frequency) primary, at 0206. (Haverlah-TX) Unid-North Korean female numbers, using powerful AM transmitter, at 1400. Similar, non-parallel, on 4770. (Yamaguchi-Japan)
- 6215.0 Unid-North Korean female numbers, in AM, at 1440. Similar, non-parallel, on 4770. (Yamaguchi-Japan) *My goodness, now they're using an international calling/distress channel.* -Hugh
- 6485.0 Lincolnshire Poacher-English female numbers, parallel 5422 and 8464, at 2200. (Yamaguchi-Japan)
- 6500.0 PCD-Mossad, Israel, numbers at 1500. (Yamaguchi-Japan)
- 6604.0 New York Volmet, with warning of Montserrat volcano ash, at 0015. Gander Radio, Volmet at 0020 (Wilden-IN)
- 6666.0 Unid-U.S. exercise with various trigraph tactical callsigns and lots of EAMs, starting at 0025. (Haverlah-TX)
- 6679.0 FD3GO-IPRNET (French pirate packet network), with, FRA3CP, FRA3NG, FRA3JF, in packet at 1655. (Boender-Netherlands) *Pacific Volmet has to love this.* -Hugh
- 6683.0 Executive One Foxtrot-USAF aircraft with First Lady aboard, enroute Hill AFB, UT, asked by Andrews to have "Evergreen" (Hillary's Secret Service code) call White House Joint Ops Center, at 0012. (Fowler-NY)
- 6697.0 Exercise, like 6666, trigraph callsigns and many coded messages, at 0045. (Haverlah-TX)
- 6730.0 Alma Ata Volmet, weather in Russian at 1355. (Yamaguchi-Japan)
- 6757.5 Unid-Rockwell ALE tones, in VFT (2400), at 2332. (Boender-Netherlands)
- 6758.0 MKL-RAF Pitraevie, United Kingdom, at 1700. (Boender-Netherlands)
- 6761.0 Jambo 31-USAF aircraft, calling Mainsail (all station call) at 0157. Gasser 24-USAF tanker, calling 25 at 0158. Steel 82 calling Steel 84, at 1545. Indy 83 calling Brickyard, female voice answers at 2238. (Fowler-NY) *Old SAC night primary, now USAF air-to-air. Jambo is probably a B-52, Indy a tanker, Brickyard a CP, which wouldn't be the first one named for a race track.* -Hugh
- 6855.0 Unid-5 figure CW number groups, at 1705. (Boender-Netherlands)
- 6870.0 Unid-5 letter groups, in CW at 0830. (Cam Castillo-Panama)
- 6959.0 Lincolnshire Poacher-English female 5-digit numbers, parallel 9251 and 10426, at 2200. (Yamaguchi-Japan)
- 6972.0 YOG59-Romanian Press, Bucharest, with news in French, RTTY (30 baud) at 1712. (Boender-Netherlands)
- 6977.0 CIW 823-Canadian Forces amateur radio system, net in progress, at 2224. (Fowler-NY)
- 6992.0 MFJ04-Royal Navy Cadets, United Kingdom, several stations at 1030. (Boender-Netherlands)
- 7374.5 KN9S-unknown, calling 2MWZ, in chirpy CW, at 0816. (Yamaguchi-Japan)
- 7527.0 T-Russian Navy single-letter CW marker, location unknown, at 0422. (Yamaguchi-Japan)
- 7540.0 JSR 2-Mossad, Israel, numbers, interfering with Adventist World Radio broadcast, parallel 5091, at 1530. (Yamaguchi-Japan)
- 7845.0 Unid-5 letter groups, ending "MINDA," in CW, at 0826. (Castillo-Panama)
- 8375.0 Unid-Chinese female 4-digit numbers, in AM, similar but non-parallel on 8300, 9725, 11430, 13750 and 15388 kHz, at 1530. (Yamaguchi-Japan)
- 8495.0 F, K-Russian Navy single letter CW markers, Vladivostok and Khabarovsk respectively, same frequency, at 0917. (Yamaguchi-Japan)
- 8573.0 CLA-Havana Radio, Cuba, CW marker with frequencies. (Castillo-Panama)



- 8655.0 UAI 3-Nakhodka Radio, CW marker, listening 8343, at 1243. (Jack Dix-NY)
- 8670.0 XSG-Mexico, CW marker and "UP 373" at 1140. (Castillo-Panama)
- 8764.0 US Coast Guard New Orleans, working several vessels in rescue of four persons aboard distressed shrimp boat *Rebel Yell*, starting at 2041. (Dean Burgess-MA)
- 8965.0 Reach 9520-USAF Air Mobility Command transport, asking Thule GHFS for patch to Dover Metro, at 2333. (Fowler-NY)
- 8983.0 USCG Miami Operations working Rescue 1718 who had recovered 4 persons and a working ELT radiolocator beacon. (Perron-MD) *Different operation from 8764 logging-Hugh.*
- 9025.0 Gofer 03-U.S. Air National Guard C-130, asking Thule GHFS for patch to Travis Metro for arrival weather, at 0044. (Fowler-NY)
- 9219.0 Unid-English female 3/2 numbers, "counter" format, at 2024 (Dix-NY)
- 9263.0 Cherry Ripe-English female 5-digit numbers, parallel 12056 and 15616, at 2200. (Yamaguchi-Japan)
- 10046.0 4XZ-Israeli Navy Haifa, with CW marker at 1704. (Boender-Netherlands)
- 10352.0 CIO-Mossad, Israel, numbers at 2344. (Boender-Netherlands)
- 10529.0 Unid-U.S. female "counter" numbers, in English, strong AM test tones. Message had low audio and hum, carrier cut after 3 minutes, at 1400. Audio normal next day, and with parallel on 7547. (Yamaguchi-Japan)
- 11175.0 USAF Andrews with patch from Evac 7 Romeo 2 (a C-141) to Casino Royale, (Westover CP). Ringbolt telling Thule Global that he can't raise Nightwatch on Z175 [9016] or Z200 [1181]. MacDill with patch to Nighthawk base from Nighthawk 51. MacDill with patch from Open Skies 35 Oscar to Treaty Compliance Office at Wright-Patterson AFB, and with NATO 28. (Perron-MD) MacDill with patch from PACAF 01 at 1842, and from Spar 50 at 2028. (Haverlah-TX) *Spar is a VIP flight. Wonder who Pacaf 1 is? Nice catch-Hugh. (PACAF 1 is the VIP aircraft assigned Commander Pacific Air Force. At last report it was a USAF C-135C aircraft tail number 12668 (61-2668) assigned to the 65 Airlift Squadron-Larry VH.)*
- 11212.0 MKL-RAF Pittravie, U.K., in CW at 1503. (Boender-Netherlands)
- 11214.0 NORAD AWACS Sentry 47 with patch to Barbie via Trenton Military, at 0145. (Fowler-NY)
- 11232.0 Canadian Forces Trenton Militaryworking Canforce 2747, enroute to RAF Lynham, given alternate frequency of 13257. (Perron-MD)
- 11244.0 USAF Andrews giving Nightwatch net frequencies, Z110 [3134] and Z130 [4472], to Teardrop, but noting that Nightwatch was not on HF. (Perron-MD)
- 11270.0 Russian Man, AM numbers, twice at 0820. (Boender-Netherlands)
- 11279.0 Alma Ata-Russian language Volmet, at 0515. (Yamaguchi-Japan)
- 11288.0 Riyadh LDOC, Saudi Arabia, working Saudia 003, at 1622. (Boender-Netherlands)
- 11297.0 Kiev-Russian language Volmet at 1125. Rostov-same at 1120. (Yamaguchi-Japan)
- 11345.0 SDJ- Stockholm Radio, Sweden, working Northwest 58 and Berlin 7315, at 1527. (Boender-Netherlands)
- 11351.0 Paris LDOC, France, company traffic with various Air France flights, at 1718. (Boender-Netherlands)
- 11354.0 Johannesburg LDOC, RSA, with Springbok 270, at 1602. (Boender-Netherlands)
- 11401.6 UNHCR, Kigoma, with message about fleet air ops (PACTOR 200) at 1700. (Bob Hall-RSA)
- 11545.0 Lincolnshire Poacher, Cyprus, 5-figure numbers at 1500, 1600, and 1700. (Boender-Netherlands)
- 11565.0 EZI 2-Mossad, Israel, numbers, parallel 12533, at 1530. (Yamaguchi-Japan)
- 12070.0 WAR 46-U.S. STRATCOM, radio checks with Nightwatch 01, at 2143. (Haverlah-TX) *This is frequency Z211 -Hugh*
- 12204.0 ZSO-South African Navy, Durban, weather in RTTY (75/170), then 5-letter groups, at 1045. (Hall-RSA)
- 12221.0 Unid-Female 3/2 numbers, in English and AM, at 1200. Similar, non-parallel broadcasts going on 9547 and 10223, same time. (Yamaguchi-Japan)
- 12730.5 NMC-USCG San Francisco, clear weather chart in FAX (120/576), at 1528. (Hall-RSA)
- 12780.5 9AR-Rijeka Radio, Croatia, CW marker at 0450 (Finerman-NY)
- 13242.0 Nightwatch 01-U.S. STRATCOM airborne command post, many EAM broadcasts and net check-ins, at 2303. (Haverlah-TX) *This is frequency Z215 -Hugh*
- 13257.0 Trenton Military-Canadian Forces, working Canforce 330. (Perron-MD)
- 13306.0 Spar 06-USAF VIP, working New York ATC enroute to Europe. (Perron-MD)
- 13527.8 P-Russian single letter marker, in CW at 1750. (Dix-NY)
- 13555.0 Unid-Female 3/2 numbers, in English and AM, parallel 14406, at 1100. (Yamaguchi-Japan)
- 14487.0 Lincolnshire Poacher, 5-figure numbers, parallel 11545 and 15682, at 1400. (Boender-Netherlands)
- 14699.0 YIX70INA-Baghdad, with English language news in RTTY (75/352), at 1521. (Hall-RSA)
- 14890.0 Russian Man, testing with interrupted carriers, then "615" ID, at 0750. Russian Man, AM numbers, twice at 0800. (Boender-Netherlands)
- 15016.0 USAF GHFS MacDill working Cardfile 712, who was enroute to NAS Jacksonville with engine problem. (Perron-MD)
- 15821.7 SAM-MFA Stockholm, 5-letter code groups for ambassador in SWED-ARQ 100/400, at 1622. (Hall-RSA)
- 15962.0 USAF Liberate calling Nightwatch 01 "on Zulu-250," with Roman Lad (?) and Austerity, at 0005. (Fowler-NY)
- 16086.0 Unid-U.S. female 3/2 numbers, in English and AM, at 1100. (Yamaguchi-Japan)
- 16106.7 SAM-MFA Stockholm, administrative message for Tunis, in SWED-ARQ, 100/400, at 1429. (Hall-RSA)
- 16228.7 Y9L-French Embassy, Pretoria, calling P6Z, Paris, in FEC-A 192/850, at 1605. (Hall-RSA)
- 16332.0 F.C.P. and S-Russian Navy single-letter CW markers, from Vladivostok, Moscow, Kaliningrad, and Alkhagansk respectively, at 0730. (Yamaguchi-Japan)
- 16936.9 Royal Navy Preston, RYs in RTTY (100/170), at 1457. (Hall-RSA)
- 17422.5 SAM-MFA Stockholm, with Swedish message for Nairobi SWED-ARQ 100/400, at 1432. (Hall-RSA) RFFVAEA-Comelel Alysse, Dhahran, many coded messages in 5 letter groups using ARQ-E3 200/400, at 1616. (Hall-RSA)
- 17425.0 Unid-printed only garbage, in RTTY (50/391), at 1505. (Hall-RSA)
- 17428.6 SAM-MFA Stockholm, Swedish message to Luanda, in SWED-ARQ 100/400, at 1705. (Hall-RSA)
- 17430.5 9VF 209-Kyodo Singapore, Japanese newspaper FAX (60/576), at 1527. (Hall-RSA)
- 17976.0 Offutt-USAF, with Skyking EAM. (Perron-MD)
- 18032.0 CLP 7-Cuban embassy, Brazzaville, coded and Spanish messages to CLP1, in RTTY (75/400), at 0852. (Hall-RSA)
- 18064.3 SNN 299-MFA Warsaw, Polish news in POL-ARQ 100/260, at 1202. (Hall-RSA)
- 18477.7 CLP 1-Minrex Havana, Spanish news in RTTY (75/455), at 1520. (Hall-RSA)
- 18538.0 NDJA-French embassy, N'Djamena, coded diplomatic message in ARQ-6 90 200/400, at 1555. (Hall-RSA)
- 18597.5 EA 220-MFA Madrid, with Spanish traffic to several embassies, in Twinplex F7B1 100/340, at 1020. (Hall-RSA)
- 18648.9 SOT 265B-PAP Warsaw, Polish news in FEC, at 1426. (Hall-RSA)
- 18760.0 RFGW-MFA Paris, coded message to all embassies, in FEC-A 192/400, at 1609. (Hall-RSA)
- 19530.5 FJY2-DISTA Kerguelen, French traffic to MetFrance in ARQ-E3 96/400, at 0800. (Hall-RSA)
- 19715.0 Unknown-Mossad, Israel, late tune in, also on 17410, at 0841. (Boender-Netherlands)
- 19736.5 ZLA-Awanui Radio, ID in CW only, no bursts, at 0340. (Yamaguchi-Japan)
- 20091.7 Boustane, Kinhasa, with 5-letter groups to Cairo, both ARQ and FEC at 0910. (Hall-RSA)
- 20496.0 Unid?-repeating "VL8IPS" in strong CW, at 0912. (Yamaguchi-Japan)
- 22387.5 SVS-Athens Radio, Greece, CW marker at 1642. (Boender-Netherlands)
- 22015.0 GTK 76-Portishead Radio, United Kingdom, with phone patch at 1028. (Boender-Netherlands)
- 22098.0 YQI 71-Constanta Radio, Romania, phone patch at 1032. (Boender-Netherlands)
- 22395.0 KPH-Globe Wireless, San Francisco, working unid vessel in SITOR-A, at 1451. (Boender-Netherlands)
- 22435.0 XSG-Shanghai Radio, China, working unid vessel, in SITOR-A at 1040. (Boender-Netherlands)
- 22723.0 SVN 72-Athens Radio, Greece, with phone patch at 1050. (Boender-Netherlands)
- 22786.0 SVN 76-Athens Radio, Greece, with phone patch at 1043. (Boender-Netherlands)



## HF Facsimile

**F**acsimile (FAX) is the transmission of pictures, charts, maps, press photos, marine information and other documents over radio and satellite. This digital mode has been around for many years and at one time the U.S. Navy could be found on many frequencies transmitting from exotic world locations. Prior to moving to satellite, many of the world press agencies used the shortwave (HF) bands to transmit press photos. Associated Press had a transmitter site in Argentina that produced fairly reliable signals for much of North America.

FAX pictures/charts are transmitted and received line-by-line. The transmitting station mounts the picture/chart on a revolving drum and the image is scanned by an optical sensor. Each pixel (picture element) is converted to an electrical voltage proportional to the lightness/darkness of the pixel. The data for each pixel is stored, and once the entire line has been scanned, it is then transmitted.

### FAX Modulation

FM modulation is used to transmit FAX images on shortwave. The tone of the frequency corresponds to the electrical voltage (lightness/darkness) of the pixel. AM modulation is used for satellite FAX transmission. The tone of the frequency is constant, but the amplitude (loudness) is proportional to the intensity of the pixel.

A typical scanned line contains 960 dots (pixels) of information. There can be up to 226 lines per inch. Weather charts are normally transmitted at 120 lines per minute (LPM) or about 2000 bits per second. A standard weather chart takes about 13 minutes to transmit and receive.

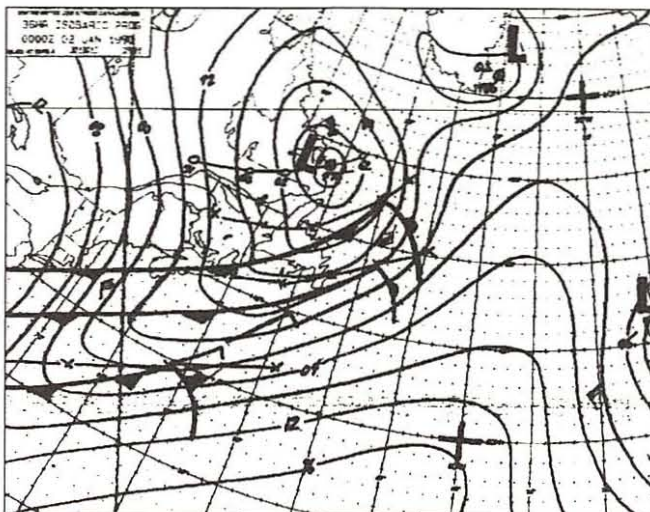
QRM (noise) and fading show up as lines and loss of detail on the received image. Every half-second of interference will obliterate one full line of the image at a speed of 120 LPM.

### Drum Speed

Various drum speeds may be used for FAX transmissions. The most common are:

- 60 LPM 1 beat per second
- 90 LPM 1.5 beats per second
- 120 LPM 2 beats per second
- 240 LPM 4 beats per second

By listening to the cadence of the signal, you can easily determine the drum speed of the scanning unit. Drum speeds of 60, 90, and 120 are commonly used for weather charts and maps, with 120 being used exclusively for North American and major international weather centers. Drum speeds of 60 and 90 are com-



mon for Russian meteorological stations. A drum speed of 60 is also used by most international news services in transmitting press photos.

### Index of Cooperation

The Index of Cooperation (IOC) determines the relationship between the width of the image and the number of lines per inch that make up the image. In effect, the IOC determines the ratio of the image's height to its width.

The two standard IOC values are 288 and 576. The value of 576 is generally used by meteorological stations while 288 is normally used by press stations.

### Polarity

FAX images may be sent in Positive or Negative (reverse) polarity. The user must choose which format is required. Press photos are generally always intended to be received in the negative mode.

### Direction

The direction of the received image can be controlled by the FAX receiving equipment. Normally images are processed from left-to-right. The exception to this is press photos, which are received right-to-left. Unless they are received in this fashion they will appear inverted (as if you held a newspaper up to a mirror).

### Format

Two formats exist for printing FAX charts and photos. *Line* is used to print weather maps and charts which are basically line drawings. *Gray* is used for photographs and produces an even gray tonal scale.

### Framing

Many FAX stations transmit signal tones at the beginning of a FAX transmission which automatically sets the correct IOC for your decoder and also properly centers the image. In the absence of these tones, you must manually frame left or right to center the image.

### Video FAX

Television monitors generally lack the resolution to display a true FAX image. In addition, they are capable of only displaying about 70% of the actual transmitted image. Computer VGA monitors now offer excellent resolution.

A printer is required to do proper justice. Nine pin printers work well, but you will obtain a better image if a 24 pin dot matrix printer is used. Many outboard and computer-based decoders now support laser printers, which offer the best printed picture possible.

### VHF Satellite FAX

Polar orbiting NOAA weather satellites transmit FAX images on frequencies of 137.500 and 137.620 MHz. The Russian METEOR weather satellites, and earth resource imagery Okean/SICH satellites transmit FAX signals on 137.300, 137.400 and 137.850 MHz.

These satellites orbit the earth about every 100 minutes. During some of their orbits they may pass over your listening post. The trick, if there is one, is to have some means of predicting when they will pass within your range of reception. If you have internet access an excellent starting point is at the website of *Satellite Times* columnist TS Kelso (<http://celestrak.com>). Internet challenged folks should contact AMSAT (phone 301-589-6062; 301-608-3410 fax) as they have programs available for several computers which can be used for this purpose.

You can find additional, detailed information on monitoring weather satellite imagery in the pages of *Satellite Times* magazine in the "View From Above" column authored by Lawrence Harris. This monthly magazine is available from Grove Enterprises (see ads in this issue of MT).

### ■ HF FAX Frequencies

Here are a few easily heard frequencies for you to try (frequencies are listed in kHz):

AFS-U.S. Air Force Air Weather Service, Omaha, NE  
3232.0, 5908.0  
CFH- Canadian Forces, Halifax, NS  
4271.0, 6496.4, 10536.0, 13510.0  
DDK-Hamburg Meteo, Germany  
7880.0, 13882.5  
IMB-Rome Meteo, Italy  
477.5, 8146.6, 13597.4  
JJC-Kyodo News Service, Japan  
8467.5, 12745.5, 17069.5  
NAM-U.S. Navy Norfolk VA  
3357.0, 8080.0, 15959.0, 20015.0  
NMF-U.S. Coast Guard, Boston, MA  
6340.5, 9110.0, 12750.0  
NPM-U.S. Navy, Pearl Harbor, HI  
4855.0, 21785.0  
NPN-U.S. Navy, Apra Harbor, Guam  
5258.0, 10253, 16027.7, 19858.0

## Here Comes the Sun; Hunt Harmonics with Hauser

After years of dormancy, the higher SW bands are coming alive as the new solar cycle starts a steady rise. Keep an ear on solar flux numbers announced by WWV at :18 past every hour and on WWVH at :45; these correspond to sunspot counts, and the higher they go, the more 21 and 25 MHz open up. Good markers are WFLA in Florida on 25870 and WJFP on 26470. Flea-powered harmonics of broadcast stations again become audible during wide-open conditions, and, due to fundamental band expansions, the frequency ranges where they appear have expanded even more:

17235-18780 = 3 x 5745-6260	27160-27690 = 2 x 13580-13845
18700-20000 = 2 x 9350-10000	28050-30000 = 3 x 9350-10000
19000-20400 = 4 x 4750-5100	28400-30280 = 4 x 7100-7570
21300-22710 = 3 x 7100-7570	28500-30600 = 6 x 4750-5100
22980-25040 = 4 x 5745-6260	28725-31300 = 5 x 5745-6260
23100-24320 = 2 x 11550-12160	30020-31490 = 2 x 15010-15745
23750-25500 = 5 x 4750-5100	

**ALBANIA** Radio Tirana gives their schedule at the start of their 0045 broadcast, but uses Central European Time, which they mention at the end! So all times need to be adjusted two hours for UT. I did hear Albania one night on 6115 at 0130. But then on 6220 and 7160 0130-0200, with 6115 and 7160 used 0045-0100. But that's not the end of it. They were on 7100 instead of 7160 at 0045 and 0130 one night. Back on 7160 two nights later (Ivan Grishin, Ont., *Review Of International Broadcasting*) Measured on 6220.35 at 0130 (Brian Alexander, PA, *ibid.*)

**ANGOLA** On the eve of April 2, Radio VORGAN (a Voz [da] Resistência do Galo Negro) broadcast its last transmission — an extended program to mark the occasion and offer hope that the recent political developments in Angola will bring an end to the two-decade-old civil war. VORGAN was originally scheduled to sign off on Feb 28 as part of the UN-brokered Lusaka Protocol peace agreement; however, negotiations degenerated into continued violence and the date was pushed back to Mar 30.

On April 1, the UNITA representative to the Joint Commission which is overseeing the Lusaka Protocol being put into practice, Isaias Samakuva, announced to reporters in Luanda that the station would sign off later that night. His announcement was later confirmed by an anonymous source within BBCM as well as UNITA members in Washington who were contacted by CRI.

Now that VORGAN is gone, the question remains as to where the four "containers" *Clandestine Radio Intel* discovered were being used for broadcasts will go. Unless the government in Luanda demands possession of the facilities to ensure compliance, the equipment could conceivably end up in former UNITA camps in Zambia or Congo (Nick Grace, *Clandestine Radio Intel* via DSWCI DX Window)

**AUSTRALIA** HCJB News of Autumn '98 provided the following update on developments at the property owned by HCJB at Kununurra in the Kimberley region in Western Australia, which is being developed as a possible "major national and international broadcasting facility." According to the article, HCJB has been maintaining close contact with the West Australian government and local authorities, as well as working closely with the federal government and key regulatory bodies.

"We have found there's a policy vacuum in terms of shortwave broadcasting from Australia — only Radio Australia has that privilege at present," HCJB's Australian Director David Maindonald said. [The same policy vacuum which sees Darwin's transmitters slowly moulding away in sub-tropical humidity while international broadcasters sign up for airtime at

These are the most likely "harmonic bands" but even 3 MHz stations could appear. You could extend the list lower and (if your receiver goes above 31 MHz) even higher. Note how many of the bands overlap, so if you hear a suspicious broadcaster on a certain frequency, it might have two or three possible fundamentals. Fifth and sixth harmonics impossible? Not at all: during previous solar peaks we heard a few from Latin American tropical band stations. Poorly engineered small private stations may put out significant wattage on harmonics; but well engineered major broadcasters with hundreds of kilowatts may also put out at least a few watts on harmonics and still be within spec.

Remember that harmonics must be precise integral multiples of the fundamental frequencies, and take care not to confuse the increasingly common receiver overload for genuinely propagated harmonics. In many cases the fundamental itself may not be audible due to interference or (in the daytime) because it's below the lowest usable shortwave frequency.

**Singapore - M Francis**]. HCJB lodged a formal application was lodged with the authorities in Canberra last August. In the meantime, the property is being developed as a working farm, which in turn will help fund the broadcasting and other missionary activities in northern Australia. The project has the personal support of WA Premier Richard Court, and other Christian politicians. (Matt Francis, *Electronic DX Press*) See also ECUADOR

The suspended R. Australia Cox Peninsula facility is being kept in tip-top condition by a skeleton staff (Mike Bird, R. Netherlands *Media Network*) About \$12 million was spent on upgrading the transmitters' computer systems. Restoring RA's access to at least two of the Darwin transmitters would cost barely \$3 million a year, just \$2 million more than it costs to broadcast nothing (*The Age*, Melbourne, via Dick Speckman, BC-DX)

**BULGARIA** R. Bulgaria's new 9485 to NAm in English at 2300 and 0200 ought to be good, but whenever I check it's badly bothered by a recalcitrant ute on this increasingly broadcast-only band. Must use //11720 instead (gh, OK)

**CANADA** CBC and RCI started a new Friday-filler in the last half hour of *As It Happens*. Fri 2330 on 5960, 9755 and 13670 — *C'est la vie* about Francophone Canada for Anglophones. Instead of part of yesterday's *As It Happens* and *This Morning*, RCI started carrying the first 2/3 of *This Morning* live weekdays 1205-1400 on 9640, 11855, 13650, including Mondays instead of sports, comedy (gh) [non] R. Asia Canada, Tamil to Sri Lanka 1400-1500 at 1400-1500 on 15510 ex-12005, 250 kW, 140° from Samara, Russia (Klaus Lieberwirth, BC-DX)

**CHILE** Voz Cristiana was silent for a month, but resumed testing in early April on 21550, ex-21551 (gh) Finally got license from the government (Andrew Flynn, VC via *Cumbre DX*) Studios are in Miami (HCJB DX Partyline)

**COLOMBIA** The unidentified parish broadcaster on 6201 heard last Aug. Sept and Feb around 2300-2430 has been located, in the hamlet of Tafetanes, near Granada, Antioquia. Elderly priest told me it was a "very tiny operation" (though heard in USA), now with a burned-out 6KD6 tube. It does not give any ID on the air. Though others like it use 1550, this one is not a harmonic (Henrik Klemetz, NU via *Radio Nuevo Mundo*)

**COSTA RICA** RFPI reactivated 21465 on AM and 15050 on USB with new antennas mounted atop higher towers, with much stronger signals in the daytime on 21, and 24h on 15. Planned to use 30 kW on 15050 daytime, 6980-AM at night, and lower power USB on 7385. Then HCJB started interfering on 21470 from 1815, and refused to move, even to 21475 (gh)

**CROATIA** Zagreb has their 5 minute English news

All times UTC; All frequencies kHz; \* before hr = sign on, \* after hr = sign off; // = parallel programming; + = continuing but not monitored; 2 x freq = 2nd harmonic; J-98=May-Sept; Z-98=Summer season; W-98=Winter season; [non] = Broadcast to or for the listed country, but not necessarily originating there.

at 0100, 0200 and 0300 on 9925 (A Spanish news bulletin is on at 0000). I also heard them at 0700 on 13830, but very weak (Ivan Grishin, Ont., *Review Of International Broadcasting*)

**CZECH REPUBLIC** R. Prague comes in well on 17485 at 1600-1630, a suitable replacement for the 1300 (ex-1400) English on 13580 which no longer is to NAM (Ivan Grishin, Ont., *Review Of International Broadcasting*)

**DODECANESE ISLANDS** VOA Rhodes SW relay will be closed down this summer, perhaps in July, but the MW 1260 will continue. SW sked till then is: 0400-0600 on 5965, 9865; 1700-2100 on 6040, 7105; 2100-2200 English on 6040 kHz (VOA *Communications World*)

**ECUADOR** As an additional service for listeners in the middle of the US, HCJB is now offering English programming on 15295 kHz with an antenna aimed more or less right in the direction of Enid, OK, at an azimuth of 339 degrees from Pifo, Ecuador. Although this won't be a big budget operation (around 35 kW or a little better), you should be able to hear something between 0000 to 0700 hrs UTC.

English to NAM works as follows: the 31 meter release is to run at 250 kW from 0000 to 0130, and then to switch over to 100 kW on the same antenna and heading until 0400 — this gives a little more power for the beginning part of the eastern NAM English release that typically gets a lot of competition from the European broadcasters during the early evening. At 0400, the English then switches to the curtain antenna traditionally used for western NAM (at 325 degrees) and that continues to run until 0700 as before. (Dave Lewis, HCJB frequency manager)

Interview with John Beck, Station Manager, HCJB, reports Pifo transmitter site is facing closure because it is in flight path of proposed new airport. It is not known when, or if, construction of the new airport near Pifo will take place. May be in next couple of years or in 15-20 years' time. Is 80% certain that the present government will not build new airport but it is not known whether the new government will proceed with the project. Elections are to be held in August 1998. HCJB are examining options; looking at 6-7 properties in Ecuador where a new site could be located. They are looking to expand the UK relays that have been successful. This of course would have implications for any new Ecuadorian site (*DX Partyline* via Mick Ogrizek, *Electronic DX Press*) See also AUSTRALIA

**GREECE** [non] V. of Greece relays via VOA USA sites for Z-98 turned out to include 17705 and 17765 at 1800-2200, starting with English news at local-like level; and 11730 at 1200-1350, with English at 1335; 0600-0800 on 9755, 0900-0950 on 9775 (John Babbis and gh)

**INDONESIA** VOI, English at 2000-2100 has a good signal on 15150, unfortunately blocked by RCI unless it moves (Jay Novello, NC)

**IRAN/TIBET** [non] Two clandestines established websites in mid-March, showing great similarities in design. One of them, Democratic Voice of Iran, has links to two groups that have received CIA funding: Flag of Freedom Movement, and the Constitutional Movement of Iran. Whether or not the CIA is behind this and the Tibetan clandestine's sites is unknown (*Clandestine Radio Watch*) The sites for both the Democratic Voice of Iran and Voice of Tibet, <http://www.dvi.org> and <http://www.vot.org> are hosted on the same internet server. The request.net ISP listed the Host, Master as: Internet Business Services, Millersville, MD (Pete Costello, *Review of International Broadcasting*)

**IRAQRII**, Baghdad, has been running English very unreliably at approximately 2100 and 0300 on 11785 (Bryan Alexander, PA)

[non] Rep. of Iraq Radio, V. of the Iraqi People, clandestine not to be confused with the official station, supports western policies toward Iraq and is believed to broadcast from Sa'udi Arabia: 1300-2400 daily on 9568, 9563 in Arabic with some items in Kurdish, Turkmen (BBCM)

**ISRAEL** Further confirmation that anti-Iranian clandestine V. of Southern Azerbaijan is transmitted from here: a mixing product on 21425 in the 15m hamband was heard with VOSA and Israeli audio together; it comes from VOSA's intended frequency 13645 and Israel's 17535, which are exactly the same separation in kHz (Uli Bihlmayer and Wolfgang Büschel, Germany)

**JAPAN** [non] Besides R. Japan's new 11705 via Canada at 0000-0100, English is also via Ascension to Africa on 9665, and would be quite good here if it were not for V. of Russia co-channel in Spanish. R. Japan is also showing again on the 13 and 16 meter bands direct after 0100 (gh, OK)

**LITHUANIA** [non] Information Needed On Ex-USSR Jammers: Nov 30, 1998, will mark the 10th anniversary since former Soviet Union stopped jamming of Western radio broadcasts. Rimantas Pleikys, Lithuanian Minister of Telecommunications and Informatics, is writing a booklet for that occasion. The booklet would contain a review of the history of jamming, its techniques etc. The booklet will be published in English.

He would appreciate any information, material (such as newspaper stories),

pictures, or possible staff contacts, especially for jammers with ID signals 1D, 1G, 4F, 4N, 7K, 7M, 8A, 8L.

Please email any information to Rimantas Pleikys or Sigitas Zilionis - Address: P.d. 995, LT-2300 Vilnius, Lithuania. E-mail: [dx@is.lt](mailto:dx@is.lt) Phone: +370-9927611 Fax: +370-2227454 (from Sigitas Zilionis' webpage)

**MADAGASCAR** Adventist World Radio is now relayed by a 7.5 kW transmitter at the RN relay site on 4960, to be replaced by 25 kW (Adrian Peterson, AWR) Actually on 3215, including at 0300 when WWCR is on (Mahendra Vaghjee, Mauritius) Sked is 0230-0330, 1530-1600, 1700-1730 (AWR website) AWR also using SENTECH, South Africa (Peterson)

**MALAWI** MBC's main transmitter, a 50 kW Harris, is broken down, so uses a 10 kW Gates: 0300-0800 and 1300-2200 on 3380; 0800-1300 on 5995. No longer on 7130, but parts to fix main transmitter have been ordered (Joseph Chikagwa, MBC Dir. of Engineering via Hans Johnson, *Cumbre DX*)

**NEW ZEALAND** On the fate of RNZI, current funding is going to run out in June (Adrian Sainsbury, RNZI *Mailbox* April 13 at 1130) As you are aware, RNZI has been under review. Some of the questions which are being addressed concern whether shortwave is still a viable broadcasting option given the growing importance in the region of other media such as television, and the fact that the majority of listeners in the South Pacific (RNZI's target audience) hear RNZI through relayed services over local stations. The review has also looked at some of the technical requirements necessary to maintain an international service... I expect a decision on the future of RNZI to be made shortly (Rt. Hon. Don McKinnon, Minister of Foreign Affairs and Trade in a March reply to Bill Smith, TX)

RNZI sked from May until Sept 7 if it still exists: 1650 on 6145, 1850 on 9875, 1951 on 11735, 2150 M-F only on 15115, 0459 on 9875, 0815-1206 on 6100, 1206-1650 occasional on 6100. Changeover times vary on weekends (Uwe Volk, *BC-DX*)

**PHILIPPINES** FEBC Manila has changed the sked to S.E. Asia. English can now be heard at 0000-0200 (ex 0100-0200) on 15450, 1300-1500 (ex 1400-1600) on 11995 (Alok Dasgupta, India, *DSWCI DX Window*)

**RUSSIA** Amur Radio, Blagoveshchensk, in Russian operates on 6060 at 1900-1700 including R. Russia relays, and local programmes (BBCM)

**SAIPAN** If you hear a lengthy Russian service called R. Tserkov, it's KFBS' "Radio Church" at 0900-1400 on 11650, 1400-1900 on 9465; address is P.O. Box 105, Moscow 121019 (Andreas Erbe, Germany, *BC-DX*)

**SINGAPORE** All English transmissions on HF now heard on 6150 at 2200-1600, ex-6155/6160, with effect from Z98 schedules change. Evening Radio Singapore International at 1100-1400 escapes the American frying-pan of VOA on adjacent 6160, but falls into the Canadian fire of co-channel RCI on 6150 via Korea/Japan. Serious problems with many transmissions from the BBC/Merlin site at Kranji from 24 March until the Z98 schedule change, many freqs off and numerous switching errors. Somewhat improved since then, though Swiss Radio International transmitted on BBC freqs 6195 and 9740. One wonders whether engineering work had been taking place given the increasing number of broadcasters using this relay facility? (Alan Davies, UK, temporarily in Miri, Sarawak, Malaysia, via Wolfgang Büschel)

**SUDAN** [non] The Voice of Sudan, based in Asmara, Eritrea, has opened a DX-friendly webpage as well as an E-mail address for reception reports. In December 1997, I was given the telephone number for the studios and after calling, was told the mailing address. I just got in touch with an overseas representative and received an E-mail QSL (perhaps the first Internet confirmation of a gray clandestine) along with this message: "I have been in contact with the people who are running this station, they send to you their warmest greetings and thank you for everything you have done, they received your letter, we agreed to send the confirmation of reception from here (London) and I will dedicate an E-mail for this [sudanvoice@umma.org](mailto:sudanvoice@umma.org) - please update the addresses in your site." I strongly encourage DXers to write to the Voice of Sudan via E-mail and

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thank them for providing this unique service. Reception reports can also be mailed to the NDA Secretary General (Europe): 16 Cameret Court, Lorne Gardens, London W11 4XX, UK The new site is located at: <http://www.geocities.com/CapitolHill/Senate/2884/nda/sudanvoice.html> (Nick Grace, *Clandestine Radio Intel/Watch via Cumbre DX*)

**SURINAM** Although R. Apintie, 4990, now has 1 kW thanks to a linear amplifier on its 50-watt transmitter, instead of 350 watts, and a new 6-element log-periodic antenna, this may be why we don't hear them so much any more: it is aimed to the south. Schedule is \*0730-0400\* (Hans Johnson, *Cumbre DX*)

**SWITZERLAND** [and non] Remember when the Swiss Shortwave Service had a morning broadcast to NAM at 1315? Now quite by chance a couple of transmissions to elsewhere give us good reception. The new Singapore relay at 1100-1200 on 9810 is beamed 25 degrees, which also favors NAM, just as some BBC broadcasts do. In fact, this azimuth crosses NAM: Nome-Whitehorse-Calgary-Rapid City-right on Enid!-Lake Charles. No wonder I hear it well. And the hour at 1400 on 15265 comes in surprisingly well as it is direct from Sottens, Switzerland, 500 kW at 80 degrees. At this time the only // is 9575 from Singapore, but beamed due north and the two were about equal. 9575 lags almost 2 seconds behind 15265, indicating a many-hop satellite feed (gh, OK)

[non] In cooperation with SRI we have a special report on the history and closure of Schwarzenburg on our RealAudio site, hosted by the Two Bobs, Bob Thomann and Bob Zanotti, reporting from the station on the last few hours of operation. Bob Thomann formerly worked for the station itself, back in 1954, while Bob Zanotti is still working as a journalist for SRI's English service. In the farewell you will hear the main reasons behind the closure of the station; available at <http://home.nexus.org/IRN/> (European server) and <http://www.nexus.org/IRN/> (USA server) (Alfredo Cotroneo, IRRS)



**SYRIA** 12085, Radio Damascus very good as of late for their English service at 2000. Lots of news about Syria in their opening newscast (Hans Johnson, FL, *Cumbre DX*) Also on 13610 (Mahendra Vaghjee, Mauritius)

**THAILAND** R. Thailand's English to NAM via VOA Udorn are now on 15395 at 0030 and 0300 (BBCM)

**TIBET** [non] V. of Tibet, now at 1225-1255 on 15605, 0000-0030 on 9380, thanks to tip from Victor Goonetilleke (Alok Dasgupta, India, *DSWCI DX Window*) See also IRAN [non]

**TURKEY** VOT Z-98 English heard here: 1830-1920 on 11765-USB; 2200-2250 and 0300-0350 on 9655. Turkish to NAM includes lots of great music, 0700-2100 9460, 2100-0700 9445, 2200-0400 11885. Unfortunately, 11885 is blocked by VOA-Spanish at 0100 weekdays (gh, OK)

**U K O G B A N I** [and non] Merlin Network One began a weekly Wednesday-only broadcast to Europe: 1700-1900 15200, 1900-2100 15590, 2100-2300 11915, 2200-0100 9645; and to NAM 1900-0100 13690, 2100-0100 11985, 2200-2400 9780. Programs are: 1700-1900 *Radio Caroline*; 1900-2100 *Media Zoo*; 2100-2300 *Hard Country*; 2300-0100 *Rock Radio Network*. I listened to *Media Zoo* at 1900-2100 on 13690 to NAM; //15590 to Europe, if on, was buried by KLTN which I should think would have been a problem in Eu, too. The live show was as usual extremely informal, with only occasional ads for such as visit-Calgary-this-summer. After Independent Radio News capsule at 1900, same as used by Sunrise Radio, *Media Zoo* opened with quick worldwide weather info. Rather provincial for a show with such ambition: broadcast job openings in the UK, discussion of DAB in the UK, satellite programming, etc. BTW, after 2100, 11915 came on, and it was 2-4 words ahead of 13690, indicating a multiple-hop satellite delay on 13690--so where is it from?? It's about time Merlin gave us the full info on transmitter sites! Also heard some R. Caroline in the 1700-1900 period on 15200 for Europe; good here at first, but fading toward the end (gh, OK)

*BBC On Air* for April had some interesting new frequency info. 12095 is now from Ascension at 2000-0200, replacing 11750. 9895 is listed from a USA site at 1300-1600, but not heard. WYFR relay has moved back to 11865 again this summer at 1300-1600. 5965 is shown as Antigua at 1200, but is really still Canada. Falklands service Tue and Fri only at 2130-2145 is shown on 11860 but is really still 11680 direct from UK. 15190 at 0900 is shown as Antigua, but is really still Ascension, according to monitoring and separate BBC frequency schedules via Wolfgang Büschel (gh)

Sunrise Radio, a British commercial station for the Asian community, mixing English and Hindi, experimented with SW relays via Deutsche Telekom, and

decided to keep 5850 all day and evening primarily for coverage of Britain (gh) Starts at \*0556 (Elsebuch, Germany, *hard-core-dx*)

**U S A** Here is an example of the Internet killing a station before it ever got on the air. As you may recall, KGEI sold its 250 kW transmitter to Calvary Chapel a few years ago. The chapel has over 1,000 independent and non-denominational branches in the USA. When the chapel purchased the KGEI transmitter, they moved it to Twin Falls, Idaho. The plan was to put it on the air, but they realized that this would be quite a big undertaking and that the electrical bills would be huge. The rise of Real Audio on the Internet also made them see that they could distribute their programs via the Net and then have lower-powered stations rebroadcast them. They decided to forego shortwave and use Real Audio instead. The transmitter is in storage in Twin Falls, but the chapel has no plans to put it on the air. They are trying to sell it to a religious organization that might set up the transmitter in Alaska (not KNLS). From there the new station would carry programs to the CIS, China, and Asia. The chapel would sell the transmitter, but the new buyer would air some Calvary Chapel programming. They did stress that this was hardly a done deal and that any new station was probably a couple of years away from being on the air. All this per Mike Kestler, Vice President of the Calvary Satellite Network (Hans Johnson, *Cumbre DX*) On April 13, Charles Josey of WWBS, Macon GA, told me that the power had been hooked up. They are aware of the QRM on 11910, such as Hungary before 0100, Vatican afterwards, and may prefer to use 11905, but at the moment 11910 is the only frequency authorized by the FCC for them to test (George Thurman, *Review Of International Broadcasting*)

WGTG is going high-tech! E-mail is [wgtg@ellijay.com](mailto:wgtg@ellijay.com) Our new transmitter is humming along in final assembly and test. Rewiring studio to accommodate two program lines. Second transmitter may be under different call letters, whatever the group who might lease would like. We are planning transmitters 3 and 4 in the near future also, additional antennas, perhaps a curtain (David Frantz, WGTG, *World of Radio*) And I have set up a webpage for them: <http://www.wgtg.com> (Tom Sundstrom, NJ)

WBCQ, Maine, has bought an XP5003 log-yagi antenna and 60' tower, 3-band rotatable on 7, 9, 13 MHz, 14 dBi gain. Antenna can be lowered to ground by one person in one minute if necessary for repairs (J. L. Gorski & Associates)

R. Democracy for Africa is a surprise new service announced by Pres. Clinton while visiting Botswana. It's part of VOA and some language services were to start as early as May (gh) Clinton and Congress have approved a R. Free Iran to start in Sept., probably originating in London; Prague and Washington feared terrorism (AP via Dave Alpert)

After our prodding, VOA *Communications World*, Sat 1230-1300 on Greenville 7768.5, switched from USB to LSB because of China AM on 7770; and the following week tried both USB and LSB, but carrier still reduced. Using both sidebands reduces the amount of power transmitted on either (gh, OK)

**UZBEKISTAN** 15295, Radio Tashkent, 1220-1228\* Local wailing Pop music, then male and female announcers together in English and alternating with music; a long "hard sell" request (plea!) for advertisers and advertisements giving their phone and fax numbers along with their mailing address. Very interesting! They sound desperate. S/off abruptly without warning at 1228 (Dave Valko, PA, *Cumbre DX*)

**VIETNAM** Vietnam News Agency, press radioteletype, daily, F1B, 50 baud to Eu/As: 0515-0530 French, 0535-0630 English on XVN38 18264 and XVN36 15744; 1200-1245 French, 1245-1500 English on XVN37 10600 and XVN26 9330. Times vary slightly (BBCM)

[non] VOV relay via Russia back on 7250 for Z-98, English at 0100 and 0230 (Ivan Grishin, Ont.) Viet at 0130, Laotian at 0200 to NAM! (BBCM)

**ZAMBIA** If you want to get the quickest QSL of all time please click the home page of Christian Voice: <http://www.christian-vision.org> Via the QSL-link on the left you will find there a prepared QSL-formletter. Fill in all required fields and press for certificate. That's all. A remarkable way of QSLing! (Michael Schnitzer, *DSWCI DX Window*) Er, does anyone at the station verify the accuracy before you get the certificate? (gh)

*Until the Next, Best of DX and 73 de Glenn!*



Gayle Van Horn

### 0000 UTC on 5012

DOMINICAN REP: Radio Cristal Intl. Spanish. *Latin Jazz* music program to ID. Good signal, no QRM interferences. (Dale Fisher, Cleveland, OH) Audible 2200-0100. (Richard J. LaFountain, Paulding, OH)

### 0031 UTC on 7305

TAJIKISTAN: Radio Netherlands relay. English to Asia, fair signal to co-channel Vatican Radio QRM, improving by 0100. (Lee Silvi, Mentor, OH) **Radio Netherlands Bonaire** relay 11660 at 0035. (William McGuire, Cheverly, MD)

### 0042 UTC on 9650

GUINEA: RDTV Nationale. French. Highlife music to guitar interval signal. Sign-on ID, return to music segment at 0051, tentative on //15310. (Bill Harms, MD/Hard Core DX)

### 0043 UTC on 4824.4

PERU: La Voz de la Selva. Spanish. Flute music to female announcer. Station ID, SINPO=24342. (Mark Veldhuis, Borne, Netherlands/HCDX) Peru's **Radio Horizonte** 2320-2345 on 5018.7 (Michael Schnitzer, Germany/HCDX) **Radio Andina** 958-1030 on 4995.58, poor audio. (Al Quaglieri, Albany, NY)

### 0050 UTC on 2390

GUATEMALA: La Voz de Atitlan. Spanish. SIO=322, mixing with Mexico. Classical flute music to 0102\*. Guatemala's **Radio Coatan** 1145 on 4779.8; **Radio Buenas Nuevas** 0020 on 4779.8; **Radio Tezulutlan** 1220 on 4835. (Harold Frodge, Midland, MI) **Radio Cultural** 1100-1300 on 4779.725. (Tom Roach, Grass Valley, CA) **Union Radio** reactivated 5981.4 at 1115. (Hans Johnson, CO/Cumbre DX)

### 0125 UTC on 5770

NICARAGUA: Radio Miskut. Spanish. Reggae music from Bob Marley. Station ID and mentions of Puerto Cabezas, better in USB mode. Monitored past 0200, their usual sign-off time. (Renato Bruni, Ferrara, Italy/Gatflash!)

### 0203 UTC on 4874.98

BRAZIL: Radio Roraima. Portuguese chat to talk of Roraima, Boa Vista. Canned ads to Braz pops. (Giovanni Serra, Rome, Italy/The Four Winds)

### 0214 UTC on 4939.46

VENEZUELA: Radio Amazonas. Spanish. Disco music to ballads. DJ's talk and canned promos to slogans. Station ID, "esta es Radio Amazonas." (Serra, Italy/TFW)

### 0230 UTC on 15485

PAKISTAN: Radio Pakistan. Sign-on anthem to ID. Slow speed news to station ID. (Virgil Carlson, Kirkland, MD) 5055 at 1430 with Koran readings. (Steve Martin, CA/Cumbre DX)

### 0245 UTC on 4924

BOLIVIA: Radio San Miguel. Spanish programming of regional music and talk, 0300\* ID. (Enrique Alejandro Wembagher, Buenos Aires, Argentina) Station's religious text heard 1016. (Harold Frodge, Midland, MI)

### 0248 UTC on 4820

BOTSWANA: Radio Botswana. Barnyard interval signal to 0300. Sign-on national anthem and opening announcements in vernacular language. Frequency quote for 90, 60, 41 and 31 meter bands. Good to very good signal. (Walter Salmaniwi, Victoria BC Canada; Roach, CA)

### 0310 UTC on 5075

COLOMBIA: Caracol. Spanish. Station ID, evening regional announcements and time check. (Wembagher, ARG)

### 0505 UTC on 9675

SOUTH AFRICA: Channel Africa. English news bulletin, station IDs and *Dateline Africa* program. Co-channel interference from RAI. (Salmaniwi, CAN)

### 0518 UTC on 5470

LIBERIA: Radio Veritas. Religious text in vernaculars, English 0528 with IDs and program preview. Cock crow signal 0530 into English news. (Quaglieri, NY; Johnson, CO)

### 0615 UTC on 15120

NIGERIA: Voice of. National tourism segment to program preview. Drum signal and time check. Station ID to newscast. (Klaus Elsebusch, Marienthal, Germany/HCDX) Monitored 1037-1055 on 15120. (Veldhuis/NLD/HCDX; Frodge, MI; McGuire, MD)

### 0808 UTC on 5020

SOLOMON ISLANDS: SIBC. Pidgin English news and time check as "seven o'clock." News for the Catholic church and program about Bougainville at 0811. (Salmaniwi, CAN)

### 0907 UTC on 6185

MEXICO: Radio Educacion. English tourism show on Guadalajara. Spanish/English ID into Spanish segment. (Quaglieri, NY)

### 0929 UTC on 9725

BRAZIL: Radio Clube Paranaense. Portuguese. Rarely heard station in the South Pacific. Also noted rare Brazilian's **Radio Record** 9505, **Radio Gazeta** 9685. (Paul Ormandy, New Zealand, HCDX)

### 0931 UTC on 5949.42

GUYANA: GBC. Odd subcontinental/tropical music to ID. Brief speech on woman's equality, back to music, covered by **WYFR** \*0955. (Quaglieri, NY)

### 1155 UTC on 4874.506

CHINA: Voice of Jinling. Domestic service in Chinese. Time signal tones to announcer's ID in regional language for newscast. **China Radio Intl** 4883.009 at 1300-1400. (Roach, CA)

### 1223 UTC on 7130

TAIWAN: Taipei Radio Intl. Features on Taiwanese culture to ID 1227. Chinese music to *Reflections* folk story segment. (Frodge, MI)

### 1230 UTC on 11650

SWEDEN: Radio Sweden. English service to North America for *In Touch With Stockholm* program. (Michael C. McCarty, Galloway, OH)

### 1243 UTC on 13625

FRENCH GUIANA: Radio France Intl relay. *Club 9516* program hosted by David Page, //relay 17575 fair. (McCarty, OH) **RFO Guyane** 2356-0020 on 5055. (Silvi, OH)

### 1303 UTC on 13680

BELGIUM: Radio Vlaanderen Intl. *Brussels Calling* show including IDs, weather report, government news and item on Iraq's shortwave station including frequency schedule. (McCarty, OH)

### 1350 UTC on 15020

INDIA: AIR (Delhi). Regional language to sitar music. AIR (Bangalore) 1800-1940 on 11620//13780. (Silvi, OH; Jerry Monroe/HCDX)

### 1410 UTC on 6937

CHINA: Yunnan PBS. Instrumental Chinese music. Lady announcer with titles, jammer for ten minutes on frequency. (Zacharias, Thessolniki, Greece/HCDX)

### 1718 UTC on 4976

UGANDA: Radio Uganda. English programming of news and chat. (Francesco Clemente, Udine, Italy/Gatflash!)

### 1826 UTC on 4775

GABON: RTV Gabonaise. French music and announcers. Signal is undermodulated with carrier QRM. (Liangas, GRC) 2246-2309 on 4777. (Silvi, OH)

### 1850 UTC on 6285

GEORGIA: Voice of Hope. Fair-good signal quality with religious programming. (Ormandy, NZ)

### 1903 UTC on 3905

INDONESIA: (Irian Jaya) RRI-Merauke. Indonesian programming including regional music and notes from male announcer. Indo's **RRI Jambi** (Sumatera) noted on 4925 at 2337. (Francesco Clemente, Udine, Italy/Radio DX Net) **RRI-Jakarta** (Java) 1655 on 15150. (Carlson, WA)

### 1935 UTC on 15476

ANTARTICA: LRA36-Radio Nacional. Female DJ with Spanish chat and tango music bridges to text. Surging signal past 1950. (Ormandy, NZ)

### 2000 UTC on 7170

SENEGAL: RTV Du Senegal. French news and comments to DJ's phone chat with listeners. (Wembagher, ARG)

### 2045 UTC on 11830

BRAZIL: Radio Anhanguera. Portuguese service with talk, IDs and Brazo pops. Brazil's **Radio Brasil Central** on 11815 at 2107; **Radio Gaucha** on 11915 at 2114. (Alessandro Bertoglio, Torino, Italy/Gatflash!)

### 2101 UTC on 11775

ANGUILLA: Caribbean Beacon. Dr. Scott's religious programming including pop/rock music breaks. (Pierluigi Calligaro, Udine, Italy/Radio DX Net)

### 2130 UTC on 11735

URUGUAY: Radio Oriental. Spanish/Portuguese. Uruguayan folklore songs to 2200 ID, "oriental la radio mundial. Sports news to RAI Italy segment 2210-2214, Portuguese to 2217. (Schnitzer, Germany/HCDX) Special broadcast of Uruguay's **CXA42, Emisora Ciudad de Montevideo** on 9650 to 0400. (Horacio A. Nigro, Montevideo, URG)

### 2304 UTC on 5047

TOGO: Radio Togolaise. Mostly American pop/rock tunes from French DJ also IDing as Radio Lome. (Silvi, OH)

### 2313 UTC on 9584.9

BRAZIL: Radio Globo. Portuguese. Sports program, sound effects to jingle with ID. Brazil's **Radio Cultura** at 2320-2345 on 9615. (Veldhuis, NLD)

### 2315 UTC on 4930.6

HONDURAS: Radio Internacional. Very good signal despite QRM from CW and RTTY stations. Tangos to ID/commercials. SINPO=43343. (Veldhuis, NLD) **HRMI** audible 5890 at 2305. (Frodge, MI)

Thanks to our contributors — Have you sent in YOUR logs?  
Send to **Gayle Van Horn**, c/o *Monitoring Times* (or e-mail [gayle@grove.net](mailto:gayle@grove.net))  
English broadcast unless otherwise noted.

## DXing the Underground

Delving into clandestine (guerrilla) broadcasting unveils a spectrum full of intrigue and mystery. These broadcasts are generally politically motivated and anti-government — whatever target that may be. The most active broadcasters these days remain in the Middle East. Times and frequencies for “clannies” are very subject to change, and some may use more than one transmitter at a time. *MT* columnist George Zeller maintains an excellent source of current updates in his monthly column, *Outer Limits*.

*Clandestine Radio Watch* is a biweekly report which centralizes the latest news and developments affecting the clandestine



stations. CRW can be accessed online at: <http://www.geocities.com/CapeCanaveral/2594/geo-cla.htm>

Pirates (free radio) transmit music, fake call signs, parodies, and are outrageous! Pirates have been heard on longwave, medium wave, FM and TV. Most broadcast in USB or AM mode on 3230 kHz, from 6218 to 6950, with 6955 kHz the most widely heard on weekends and holidays between 1300 and 0300 UTC. Where else in the radio spectrum would you hear the likes of Betty Boop Radio and the Voice of Stupidity?!

The Association of Clandestine Radio Enthusiasts (ACE) newsletter is published monthly. For more underground and pirate information, go to the ACE website at: <http://www.frn.net/ace/>

### CLANDESTINE

Radio Fana, 6210 kHz. Full data small green QSL card with signature and stamped with station's seal. Received in 50 days via registered mail for one U.S. dollar and one IRC. (Lee Silvi, Mentor, OH) Cumbre DX # 180 reports this station also on 6940 kHz, veri signer as Hameimat Tekle Haimanot-General Manager, P.O. Box 30702, Addis Ababa, Ethiopia. - ed.

Radio Kudirat, 6208 kHz. Verification letter signed by Kayode Fayemi-Director of Communications, NALICON. Noted target area as Nigeria and West Africa, transmitter location not revealed “due to political and security reasons.” Permanent QSL cards to follow with station stamp and seal included. QSL address: P.O. Box 9663, London SE1 3ZD England. (Klaus Kohler, Germany/Hard Core DX)

### MEDIUMWAVE

KWKH-AM 1130 kHz. Full data letter and business card signed by Traci Myers-Programming Dept. Received in one year, 15 days for an AM report and an SASE. Station address: 6341 Westport Ave., P.O. Box 31130, Shreveport, LA 71130-1130. (Terry Jones, Plankinton, SD)

WTOP-AM 1500 kHz. Full data station QSL card unsigned. Received in nine days for an AM report and souvenir postcard of Maine. Station address: 3400 Idaho Ave. NW, Washington, DC 20016. (Ed Hundley, Biddeford, ME)

WPHG-AM 1620 kHz. No data station QSL folder card unsigned. Received for an AM report and mint stamps. Station address: Maranatha Ministries Inc., 89 North Main St., Atmore, AL 36502. (Hank Holbrook, Tracys Landing, MD)

### PIRATES

Argosy Magazine, 6956 kHz USB. Full data xeroxed copy of old Argosy magazine cover, signed by Edgar Rice Burroughs. Received in 121 days for a pirate report and one U.S. dollar. QSL maildrop: P.O. Box 293, Merlin ON Canada N0P 1W0. (William R. Wilkins, Springfield, MO)

Friday Radio, 6955 kHz USB. Small full data *Friday or Bust* QSL sheet # 82, unsigned. Received in 104 days for an English pirate report and three mint stamps. QSL maildrop: P.O. Box 28413, Providence, RI 02908. (Wilkins, MO)

Laser Hot Hits, 6955 kHz USB. Full data blue and white QSL card unsigned. Small posters, decals and form letter enclosed. Received in 92 days for a pirate report and one U.S. dollar. Report sent to Merlin maildrop, QSL response received from England. (Wilkins, MO)

Lounge Lizard Radio, 6955 kHz USB. Full data Tom Jones and Al Martino sheets signed by Dean Soundgarden. Received in 90 days for a pirate report and three mint stamps. QSL maildrop: P.O. Box 28413, Providence, RI 02908. (Sam Wright, Biloxi, MS)

MARS Montana Audio Relay Service, 6955 kHz USB. Full data Clinton

Memorial and Unabomber sheets signed by Dreeble. Absurd Taxes editorial and excerpts from Unibomber Manifesto included, as well as product labels from Chef Boyardee tortellini. Pirate report and three mint stamps to QSL maildrop: Merlin, ON address. (Harold Frodge, Midland, MI)

Mystery Radio, 6955 kHz USB Full data Beatles, Haunted House and Daydream cards signed by The Shadow. Business card for Giggles-Station Operator enclosed. Pirate report and three mint stamps to QSL maildrop: P.O. Box 146, Stoneham, MA 02180. (Frodge, MI)

Radio Eclipse, 6955 kHz USB. Full data QSL letter and card signed by Steve Mann. Received in 58 days for a pirate report and three mint stamps. QSL maildrop: Providence, RI. (Charlie Washburn, North Perry, ME)

Radio Free Speech, 6955 kHz USB. Full data card and newsletter signed by Bill O. Rights. Received in 26 days for a pirate report and three mint stamps. QSL maildrop: P.O. Box 452, Wellsville, NY 14895. (Washburn, ME)

Radio Gerbil, 6955 kHz USB. Full data *It Wasn't Us* QSL sheet unsigned. Pirate report sent to Radio Azteca QSL maildrop: P.O.Box 1, Belfast, NY 14711. (Frodge, MI)

Radio Neehenthchrin, 6955 kHz AM. Full data Radio Nederland logo sheet signed by Pirates Jim and Tom. Received in 15 days for a pirate report and three mint stamps. QSL maildrop: P.O. Box 334, Bremen, IN 46506. (Frodge, MI)

Radio USA, 6955 kHz USB. Full data QSL letter and info sheet unsigned. Received in 134 days for a pirate report and three int stamps. QSL maildrop: Belfast, NY (Washburn, ME)

Rock It Radio, 6955 kHz USB. Full data yellow logo card signed by Bennie Dingo-Operator. Form letter enclosed. Received in 24 days for a pirate report and three mint stamps (used on reply). QSL maildrop: P.O. Box 5617, Ventura, CA 93005. (Wilkins, MO)

Take It Easy Radio, 6955 kHz USB. Color full data QSL certificate signed by Desperado-Head DJ. *Take It Easy Radio* pirate flag plus decal and letter. Received in 150 days for a pirate report and three mint stamps (used on reply). QSL maildrop: Belfast address. (anonymous, TX)

We Love Interval Signals, 6955 kHz USB. Full data *Ian McFarland Attends His 1st DXpedition* sheet signed by Charles Poltz. Received in 46 days for a pirate report and three mint stamps. QSL maildrop: P.O.Box 109, Blue Ridge Summit, PA 17214. (Anonymous, TX)

World Radio Parody, 6955 kHz USB. Full data card and letter signed by Capt. Squirtlong. Received in 63 days for a pirate report and three mint stamps. QSL maildrop: P.O. Box 605, Huntsville, AL 35804. (Washburn, ME)

## HOW TO USE THE SHORTWAVE GUIDE.....

### 1: Convert your time to UTC.

Eastern and Pacific Times are already converted to Coordinated Universal Time (UTC) at the top of each page. The rule is: convert your local time to 24-hour format; add (during Daylight Savings Time) 4, 5, 6, or 7 hours for Eastern, Central, Mountain or Pacific Times, respectively.

Note that all dates, as well as times, are in UTC; for example, a show which might air at 0030 UTC Sunday will be heard on Saturday evening in America (8:30 pm Eastern, 5:30 pm Pacific).

### 2: Choose a program or station you want to hear.

Some selected programs appear on the lower half of the page for prime listening hours—space does not permit 24-hour listings.

Occasionally program listings will be followed by "See X 0000." This information indicates that the program is a rerun, and refers to a previous summary of the program's content. The letter stands for a day of the week, as indicated below, and the four digits represent a time in UTC.

S: Sunday T: Tuesday H: Thursday A: Saturday  
M: Monday W: Wednesday F: Friday

### 3: Find the frequencies for the program or station you want to hear.

Look at the page which corresponds to the time you will be listening. Comprehensive frequency information for English broadcasts can be found at the top half of the page. All frequencies are in kHz.

The frequency listing uses the same day codes as the program listings; if a broadcast is not daily, those day codes will appear before the

station name. Irregular broadcasts are indicated "tent" and programming which includes languages besides English are coded "vl" (various languages).

### 4: Choose the most promising frequencies for the time, location and conditions.

Not all stations can be heard and none all the time on all frequencies. To help you find the most promising frequency, we've included information on the target area of each broadcast. Frequencies beamed toward your area will generally be easier to hear than those beamed elsewhere, even though the latter will often still be audible. Every frequency is followed by one of these target codes:

am: The Americas	as: Asia
na: North America	au: Australia
ca: Central America	pa: Pacific
sa: South America	va: various
eu: Europe	do: domestic broadcast
af: Africa	om: omnidirectional
me: Middle East	

Consult the propagation charts. To further help you find the right frequency, we've included charts at the back of this section which take into account conditions affecting the audibility of shortwave broadcasts. Simply pick out the region in which you live and find the chart for the region in which the station you want to hear is located. The chart indicates the optimum frequencies for a given time in UTC.

## HOT NEWS.....

COMPILED BY JIM FRIMMEL

**MERLIN NETWORK ONE.** One year after its creation for the purpose of privatizing the transmission facilities of the BBC, Merlin Communications began a new service for international specialist broadcasters. Merlin's initial program lineup of British program producers began as a one-day-a-week experiment in early April. The 8-hour schedule on Wednesdays is:

1700-1900 *Radio Caroline* (eu)  
1900-2100 *Media Zoo* (am/eu)  
2100-2300 *Hard Country* (am/eu)  
2300-0100 *Rock Radio Network* (am/eu)

Check their web site for up-to-date programming  
<[www.merlincommunications.com](http://www.merlincommunications.com)>.

See the centerfold guide for frequencies.

**HEADCRASH.** Deutsche Welle aired a computer magazine program from Oct 93 to Oct 97. It reported on new software, hardware trends, operating systems and games. *Headcrash* can now be heard exclusively via the Internet <[www.dwelle.de/english/headcrash/Welcome.html](http://www.dwelle.de/english/headcrash/Welcome.html)>.

**RUSSIA.** Having trouble finding those elusive frequencies to hear the Voice of Russia? Aim your internet browser to TRS Consultants web page for a listing of what's currently being heard in the U.S. <[www.trsc.com/vor\\_z98.html](http://www.trsc.com/vor_z98.html)>.

**FRANCE.** Dish Network subscribers can now receive

Radio France International (RFI) and TV5 in French. These are additional cost services—\$1.00/month for RF and \$9.99/month for TV5.

**WGTG.** Another international broadcaster is now on the web. You can find WGTG's complete schedule at <[www.wgtg.com](http://www.wgtg.com)>. The webmaster is Tom Sundstrom (TRS Consultants), who also keeps us current at the WWCR web site.

**WRN.** The World Radio Network reports continued growth with 1,000 new listeners a week to their Internet audio services. Consequently, WRN is upgrading its on-demand audio services and plans to establish a mirror web site in the U.S.

**SELECTED PROGRAMS.** This month's centerfold listing features the complete schedules of World Harvest Radio International (WHRI/WHRA/KWHR), Radio Canada International (RCI), and Radio Netherlands. Also included are listings for Radio Japan for UT 00, 03, 06, and 14 hours. Radio Japan has juggled its program lineup somewhat and introduced *My Japan Diary* (Thursdays at 03/06/11/15/21). Also too late to be included in the listing for RCI are CBC programs to the U.S. at 0200 Sun (*The Great Eastern*), 1300 Mon (*Peter Gzowski's Forum* and *Out Front*), and at 2230 Fri (*C'est la Vie*). *C'est la Vie* is a new program billed as an irreverent and revealing current affairs program on Francophone culture throughout Canada.

English Z-98:		
0300-0330	5955	East and Central Africa
0400-0430	5955	Southern Africa
0500-0530	9525	West Africa
0600-0630	11900	West Africa
1300-1455	17675	West Africa * (Sat/Sun only)
1300-1455	17870	East and Central Africa * (Sat/Sun only)
1300-1455	9445	Southern Africa * (Sat/Sun only)
1500-1530	9445	East and Central Africa
1600-1625	6000	Southern Africa
1700-1730	15240	West Africa
1800-1830	15240	West Africa
(Kathy Otto, SENTECH)		

## FREQUENCIES

0100-0200	Anguilla, Caribbean Beacon	6090am				0100-0200	Singapore, R Corp Singapore	6150do		
0100-0200	Australia, Radio	9660pa	12080as	13605pa	15240pa	0100-0130	Slovakia, R Slovakia Intl	5930na	7300af	9440sa
		15415as	15510pa	17750as	17795pa	0100-0200	Spain, R Exterior Espana	6055am		
0100-0200 vl	Australia, VL8K Katherine	5025do				0100-0200	Sri Lanka, Sri Lanka BC	9730as	15425as	
0100-0200 vl	Australia, VL8T Tent Crk	4910do				0100-0130	Sweden, Radio	11985as		
0100-0200	Canada, CBC N Quebec Svc	9625do				0100-0130	Switzerland, Swiss R Intl	9885na	9905ca	
0100-0200	Canada, CFRX Toronto	6070do				0100-0200	UK, BBC Asian Service	5965as	6195as	9410as 9605as
0100-0200	Canada, CFVP Calgary	6030do						11955as	15280as	15310as 15360as
0100-0200	Canada, CHNX Halifax	6130do				0100-0200	UK, BBC World Service	5970sa	5975am	6175na 9590am
0100-0200	Canada, CKZN St John's	6160do						9915sa	12095sa	
0100-0200	Canada, CKZU Vancouver	6160do						5810am	9815am	
0100-0129	Canada, R Canada Intl	5960am	9535am	9755am	11715am	0100-0200	USA, KAIJ Dallas TX	7555am		
		13670am				0100-0200	USA, KJES Mesquite NM	7510am		
0100-0200	Costa Rica, RF Peace Intl	7385am	15050am			0100-0200	USA, KTNB Salt Lk City UT	17510as	17555pa	
0100-0105	Croatia, Croatian Radio	9925am				0100-0200	USA, KWHR Naalehu HI	7115as	7200as	9635as 11705as
0100-0200	Cuba, Radio Havana	6000na	9820na	9830na		0100-0200	USA, Voice of America	11725as	11820as	15250as 17740as
0100-0127	Czech Rep, Radio Prague	6200na	7345na					17820as		
0100-0200	Ecuador, HCJB	9745na	12015na	21455am		0100-0200 twtfa	USA, Voice of America	5995am	6130am	7405am 9445am
0100-0150	Germany, Deutsche Welle	6040na	6085na	6145na	9640na			9775am	13740am	
		11810am				0100-0200	USA, WENW Birmingham AL	5825eu		
0100-0115	Ghana, Ghana Broadc Corp	3366do	4915do			0100-0200	USA, WGTG McCaysville GA	5085am		
0100-0130	Hungary, Radio Budapest	6120na	9580na			0100-0200	USA, WHRI Noblesville IN	5745am	7315am	
0100-0200	Indonesia, Voice of	9525as	11785as			0100-0200	USA, WINB Red Lion PA	11950am		
0100-0130	Iran, VOIRI	9022eu	9650eu	9685eu		0100-0200	USA, WJCR Upton KY	7490na	13595na	
0100-0200	Ireland, Unt Christian BC	6200do				0100-0200	USA, WRMI/R Miami Intl	9955am		
0100-0110	Italy, RAI Intl	6010na	9675na	11800na		0100-0200	USA, WRNO New Orleans LA	7355am		
0100-0200	Japan, R Japan/NHK World	6150af	11860as	11870af	15570as	0100-0200	USA, WSHB Cypress Crk SC	7535am	9430am	
		15590as	17810as	17835sa	21610pa	0100-0200	USA, WWCR Nashville TN	3215am	5070am	7435am 13845am
		21670pa				0100-0200	USA, WYFR Okeechobee FL	6065na	9505na	11550as
0100-0200	Liberia, LCN/R Liberia Int	5100do				0100-0127	Vietnam, Voice of	5940am		
0100-0200	Malaysia, Radio	7295do				0125-0200	Netherlands, Radio	9855as	11655as	12090as
0100-0125	Netherlands, Radio	6020na	6165na	9845na	9855as	0129-0159	Canada, R Canada Intl	5960am	9755am	
		11655as	12090as			0129-0159 sm	Canada, R Canada Intl	9535am	11715am	13670am
0100-0200	New Zealand, R NZ Intl	17675pa				0130-0200	Albania, R Tirana Intl	6218na	7160na	
0100-0200 vl	Papua New Guinea, NBC	9675do				0130-0150	Greece, Voice of	7450na	9375na	9420na 9935na
0100-0200	Philippines, FEBC/R Intl	15450as						11645na		
0100-0200	Russia, Voice of Russia WS	9665na	15050na	15520na		0140-0200	Vatican State, Vatican R	7335au	9650au	

## SELECTED PROGRAMS

## Sundays

- 0100 Canada, RCI Montreal: RCI News. News, weather, and sports from Radio Canada International.
- 0100 KWHR (Angel 4): The Water of Life Broadcast. Doyle Davidson preaches from Plano, Texas.
- 0107 Canada, RCI Montreal: Venture Canada. A new weekly magazine promoting Canadian business achievement.
- 0131 Canada, RCI Montreal: Earth Watch. The magazine on environment, science and ecology matters.

## Mondays

- 0100 Canada, RCI Montreal: RCI News. See S 0100.
- 0100 KWHR (Angel 3): The Call to Worship. See S 0600.
- 0100 KWHR (Angel 4): UPI News. See S 0000.
- 0100 WHRI (Angel 1&2): UPI News. See S 0000.
- 0105 KWHR (Angel 4): Music. See S 0005.
- 0105 WHRI (Angel 1): Music. See S 0005.
- 0105 WHRI (Angel 2): Radio Free America (live). Tom Valentine hosts this talk/interview program.
- 0107 Canada, RCI Montreal: The Arts in Canada. A look at the Canadian arts scene.
- 0130 KWHR (Angel 3): Christ Gospel Broadcast. See S 1330.
- 0131 Canada, RCI Montreal: The Mailbag. See S 1337.
- 0145 KWHR (Angel 3): Message to Israel. See S 1500.

## Tuesdays

- 0100 Canada, RCI Montreal: RCI News. See S 0100.
- 0100 KWHR (Angel 3&4): UPI News. See S 0000.
- 0100 WHRI (Angel 1): UPI News. See S 0000.
- 0100 WHRI (Angel 2): The Prophecy Club. See M 0400.
- 0105 KWHR (Angel 3): Turn Your Radio On. See S 0300.
- 0105 KWHR (Angel 4): Music. See S 0005.
- 0105 WHRI (Angel 1): Music. See S 0005.
- 0111 Canada, RCI Montreal: Spectrum. See M 1341.
- 0130 WHRI (Angel 2): The Hour of Courage. See M 0430.
- 0155 Canada, RCI Montreal: News. See S 1500.

## Wednesdays

- 0100 Canada, RCI Montreal: RCI News. See S 0100.
- 0100 KWHR (Angel 3&4): UPI News. See S 0000.
- 0100 WHRI (Angel 1): UPI News. See S 0000.
- 0100 WHRI (Angel 2): The Prophecy Club. See M 0400.
- 0105 KWHR (Angel 3&4): Music. See S 0005.
- 0105 WHRI (Angel 1): Music. See S 0005.
- 0111 Canada, RCI Montreal: Spectrum. See M 1341.

- 0130 WHRI (Angel 2): The Hour of Courage. See M 0430.
- 0155 Canada, RCI Montreal: News. See S 1500.

## Thursdays

- 0100 Canada, RCI Montreal: RCI News. See S 0100.
- 0100 KWHR (Angel 3&4): UPI News. See S 0000.
- 0100 WHRI (Angel 1): UPI News. See S 0000.
- 0100 WHRI (Angel 2): The Prophecy Club. See M 0400.
- 0105 KWHR (Angel 3&4): Music. See S 0005.
- 0105 WHRI (Angel 1): Music. See S 0005.
- 0111 Canada, RCI Montreal: Spectrum. See M 1341.
- 0130 WHRI (Angel 2): The Hour of Courage. See M 0430.
- 0155 Canada, RCI Montreal: News. See S 1500.

## Fridays

- 0100 Canada, RCI Montreal: RCI News. See S 0100.
- 0100 KWHR (Angel 3&4): UPI News. See S 0000.
- 0100 WHRI (Angel 1): UPI News. See S 0000.
- 0100 WHRI (Angel 2): The Prophecy Club. See M 0400.
- 0105 KWHR (Angel 3&4): Music. See S 0005.
- 0105 WHRI (Angel 1): Music. See S 0005.

- 0111 Canada, RCI Montreal: Spectrum. See M 1341.
- 0130 WHRI (Angel 2): The Hour of Courage. See M 0430.
- 0155 Canada, RCI Montreal: News. See S 1500.

## Saturdays

- 0100 Canada, RCI Montreal: RCI News. See S 0100.
- 0100 KWHR (Angel 3): Home Schooling. Terry and Vicki Brady of the Home Education network take calls about schooling.
- 0100 KWHR (Angel 4): UPI News. See S 0000.
- 0100 WHRI (Angel 1): UPI News. See S 0000.
- 0100 WHRI (Angel 2): The Prophecy Club. See M 0400.
- 0105 KWHR (Angel 4): Music. See S 0005.
- 0105 WHRI (Angel 1): Music. See S 0005.
- 0111 Canada, RCI Montreal: Spectrum. See M 1341.
- 0130 WHRI (Angel 2): The Hour of Courage. See M 0430.
- 0154 Radio Netherlands: Documentary. Philippines (Parts 1 and 2) (6th/13th). See W 1154.
- 0154 Radio Netherlands: Documentary. The High C's (Parts 1 and 2) (21st/28th). An investigation into diamonds, the trade, their history, and their unique properties.
- 0155 Canada, RCI Montreal: News. See S 1500.

## MT MONITORING TEAM

Gayle Van Horn  
Frequency Manager  
gayle@grove.net

Jim Frimmel  
Program Manager  
frimmel@startext.net

Jacques d'Avignon  
Propagation Forecasts  
Ontario, Canada  
monitor@rac.ca

Dave Datko, California  
Mark Fine, VA

## THANK YOU...

## ADDITIONAL CONTRIBUTORS TO THIS MONTH'S SHORTWAVE GUIDE:

Joe Brasier, WHRI; Craig Carl, Shelbyville, AL; Bob Fraser, Cohasset, MA; Glenn Hauser, Enid, OK, *DX Report & WOR*; Frank Hillton, Charleston, SC; J. Klingenfuss, *SWFG 98*; Rev. Michael G. Mayer, Dover, DE; Michael C. McCarty, Galloway, OH; Kathy Otto, Channel Africa; Franco Probi, Italy; Tom Roach, Grass Valley, CA; Robert E. Thomas, Bridgeport, CT; Adrian Sandsbury, R NZ Intl; Kevin Smith, Burnt Hills, NY; Larry Van Horn, Brasstown, NC, *Satellite Times*; Valeriu Vasilica, RMI; George Woods, R. Sweden 's *Media Scan*; Sam Wright, Biloxi, MS; BBCMS/World Media; *Cumbre DX*; *DX Ontario*; *NASWA Journal*; Usenet newsgroups/PTWBW.

## FREQUENCIES

0200-0300	Anguilla, Caribbean Beacon	6090am				0200-0300	UK, BBC African Service	6135af			
0200-0300 twhta	Argentina, RAE	11710am				0200-0300	UK, BBC Asian Service	9605as	11955as	15280as	15310as
0200-0300	Australia, Radio	9660pa	12080as	13605pa	15240pa			15360as			
		15415as	15510pa	17750as	17795pa	0200-0300	UK, BBC World Service	5970sa	5975am	6175na	6195eu
								9410eu	9590am	9915sa	
0200-0300 vl	Australia, VL8K Katherine	5025do				0200-0300	USA, KAIJ Dallas TX	5810am	9815am		
0200-0300 vl	Australia, VL8T Tent Crk	4910do				0200-0230	USA, KJES Mesquite NM	7555am			
0200-0210	Bangladesh, Bangla Betar	4880do				0200-0300	USA, KTNB Salt Lk City UT	7510am			
0200-0300	Bulgaria, Radio	9485na	11720na			0200-0300	USA, KVOH Los Angeles CA	9975am			
0200-0300	Canada, CBC N Quebec Svc	9625do				0200-0300	USA, KWHR Naalehu HI	17510as	17555pa		
0200-0300	Canada, CFRX Toronto	6070do				0200-0300	USA, Voice of America	7115as	7200as	11705as	11725as
0200-0300	Canada, CFVP Calgary	6030do						11820as	15250as	17740as	17820as
0200-0300	Canada, CHNX Halifax	6130do				0200-0300	USA, WEWN Birmingham AL	5825eu			
0200-0300	Canada, CKZN St John's	6160do				0200-0300	USA, WGTG McCaysville GA	5085am			
0200-0300	Canada, CKZU Vancouver	6160do				0200-0300	USA, WHRI Noblesville IN	5745am	7315am		
0200-0229	Canada, R Canada Intl	9535am	9755am	11715am	13670am	0200-0300	USA, WINB Red Lion PA	11950am			
0200-0300	Costa Rica, RF Peace Intl	7385am	15050am			0200-0300	USA, WJCR Upton KY	7490na	13595na		
0200-0205	Croatia, Croatian Radio	9925na				0200-0300	USA, WRMJ/R Miami Intl	9955am			
0200-0300	Cuba, Radio Havana	6000na	9820na	9830na		0200-0300	USA, WRNO New Orleans LA	7355am			
0200-0300	Ecuador, HCJB	9745na	12015na	21455am		0200-0300	USA, WSHB Cypress Crk SC	5850na	7535am		
0200-0300	Egypt, Radio Cairo	9475na				0200-0300	USA, WWCR Nashville TN	3215am	5070am	5935am	7435am
0200-0230	Finland, YLE/R Finland	9780na	11900na			0200-0300	USA, WYFR Okeechobee FL	6065na	9505na		
0200-0250	Germany, Deutsche Welle	7285as	9615as	9690as	11945as	0215-0225	Nepal, Radio	5005do	7165do		
		11965as	12045as			0225-0300	Netherlands, Radio	9855as	11655as		
0200-0300	Ireland, Unt Christian BC	6200do				0229-0259 sm	Canada, R Canada Intl	9535am	9755am	11715am	13670am
0200-0300 as/vl	Italy, IRRS	7120va				0230-0300	Austria, R Austria Intl	9655na	9870sa	13730sa	
0200-0300 vl	Kenya, Kenya Broadc Corp	4885do	4935do	6150do		0230-0300	Hungary, Radio Budapest	9840na	11910na		
0200-0300	Malaysia, Radio	7295do				0230-0245	Pakistan, Radio	6070as	7485as	11760as	13610as
0200-0225	Netherlands, Radio	9855as	11655as	12090as				15485as			
0200-0300	New Zealand, R NZ Intl	17675pa				0230-0300	Sweden, Radio	7135na	9495na		
0200-0230 m	Norway, Radio Norway Intl	11645as	11990am			0230-0300	UK, BBC World Service	9895am			
0200-0300 vl	Papua New Guinea, NBC	9675do				0230-0300	Vietnam, Voice of	5940am			
0200-0300	Romania, R Romania Intl	6155na	9570na	9690as	11740as	0240-0300 vl	Zambia, R Zambia/ZNBC 2	6165do			
0200-0300	Russia, Voice of Russia WS	9665na	12040na	15520na		0245-0300 vl	Zambia, R Zambia/ZNBC 1	4910do			
0200-0300	Singapore, R Corp Singapore	6150do				0250-0300 sf	Greece, Voice of	7450na	9375na	9420na	11645na
0200-0300	South Korea, R Korea Intl	11715sa	11810sa	15575na		0250-0300	Vatican State, Vatican R	7305ca	9605am		
0200-0300	Sri Lanka, Sri Lanka BC	9730as	15425as								
0200-0300	Taiwan, Radio Taipei Intl	5950na	7130as	9680na	11740am						
		11825pa	15345as								

## SELECTED PROGRAMS

## Sundays

- 0200 Canada, RCI Montreal: CBC Radio News. News, sports, and weather from the Canadian Broadcasting Corporation.
- 0200 KWHR (Angel 3): Faith Mountain Ministries. Henry Vanderbush.
- 0200 KWHR (Angel 4): UPI News. See S 0000.
- 0200 WHRI (Angel 1): UPI News. See S 0000.
- 0200 WHRI (Angel 2): World of Prophecy. Texe Marrs and a guest discuss the evils and pitfalls of today and the outlook for tomorrow.
- 0205 KWHR (Angel 4): The Pat Boone Show. Pat Boone sings.
- 0205 WHRI (Angel 1): Music. See S 0005.
- 0206 Canada, RCI Montreal: Madly Off in All Directions. The program that travels to all points of the country to bring listeners a wide variety of comedic talent (hosted by Lorne Elliott).
- 0230 KWHR (Angel 3): Faith Christian Church. Paul Shirek.
- 0245 KWHR (Angel 3): Roger Randal Ministries. Roger Randal.

## Mondays

- 0200 Canada, RCI Montreal: CBC Radio News. See S 0200.
- 0200 KWHR (Angel 3): Methodist Hour. Music, interviews, and timely messages.
- 0200 KWHR (Angel 4): UPI News. See S 0000.
- 0200 WHRI (Angel 1&2): UPI News. See S 0000.
- 0205 KWHR (Angel 4): Music. See S 0005.
- 0205 WHRI (Angel 1): Music. See S 0005.
- 0206 Canada, RCI Montreal: Tapestry. A look at the broad range of spiritual and human issues facing people of various cultures and religions.
- 0206 WHRI (Angel 2): Radio Free America (live). See M 0105.
- 0230 KWHR (Angel 3): The Voice of Power. See S 0630.

## Tuesdays

- 0200 Canada, RCI Montreal: CBC Radio News. See S 0200.
- 0200 KWHR (Angel 3): UPI News. See S 0000.
- 0200 KWHR (Angel 4): World Harvest. See M 0600.
- 0200 WHRI (Angel 1&2): UPI News. See S 0000.
- 0205 KWHR (Angel 3): Music. See S 0005.
- 0205 WHRI (Angel 1): Music. See S 0005.
- 0205 WHRI (Angel 2): For the People (repeat). See M 0305.
- 0211 Canada, RCI Montreal: Spectrum. See M 1341.

## Wednesdays

- 0200 Canada, RCI Montreal: CBC Radio News. See S 0200.
- 0200 KWHR (Angel 3&4): UPI News. See S 0000.
- 0200 WHRI (Angel 1&2): UPI News. See S 0000.
- 0205 KWHR (Angel 3): Music. See S 0005.
- 0205 WHRI (Angel 1): Music. See S 0005.
- 0205 WHRI (Angel 2): For the People (repeat). See M 0305.
- 0211 Canada, RCI Montreal: Spectrum. See M 1341.

## Thursdays

- 0200 Canada, RCI Montreal: CBC Radio News. See S 0200.
- 0200 KWHR (Angel 3): UPI News. See S 0000.
- 0200 KWHR (Angel 4): World Harvest. See M 0600.
- 0200 WHRI (Angel 1&2): UPI News. See S 0000.
- 0205 KWHR (Angel 3): Music. See S 0005.
- 0205 WHRI (Angel 1): Music. See S 0005.
- 0205 WHRI (Angel 2): For the People (repeat). See M 0305.
- 0211 Canada, RCI Montreal: Spectrum. See M 1341.
- 0254 Radio Netherlands: Documentary. Philippines (Parts 1 and 2) (4th/11th). See W 1154.
- 0254 Radio Netherlands: Documentary. The High C's (Parts 1 and 2) (19th/26th). See A 0154.

## Fridays

- 0200 Canada, RCI Montreal: CBC Radio News. See S 0200.
- 0200 KWHR (Angel 3): UPI News. See S 0000.
- 0200 KWHR (Angel 4): World Harvest. See M 0600.
- 0200 WHRI (Angel 1&2): UPI News. See S 0000.
- 0205 KWHR (Angel 3): Music. See S 0005.
- 0205 WHRI (Angel 1): Music. See S 0005.
- 0205 WHRI (Angel 2): For the People (repeat). See M 0305.
- 0211 Canada, RCI Montreal: Spectrum. See M 1341.

## Saturdays

- 0200 Canada, RCI Montreal: CBC Radio News. See S 0200.
- 0200 KWHR (Angel 3): UPI News. See S 0000.
- 0200 KWHR (Angel 4): World Harvest. See M 0600.
- 0200 WHRI (Angel 1&2): UPI News. See S 0000.
- 0205 KWHR (Angel 3): Bible Pathway. See M 0400.
- 0205 WHRI (Angel 1): Music. See S 0005.
- 0206 WHRI (Angel 2): For the People (repeat). See M 0305.

- 0210 KWHR (Angel 3): Alive Today. Dwayne Johnson with a short evangelical message.
- 0211 Canada, RCI Montreal: Spectrum. See M 1341.
- 0215 KWHR (Angel 3): Your Call to Christ. Jimmy Surgeoner.
- 0230 KWHR (Angel 3): DXing with Cumbre. See S 0330.

## Hello, Writers...

Do you have a topic you've always "thought about" writing up for Monitoring Times? Now is the time! Given our full-spectrum coverage, plus the interest in new technology on the one hand and nostalgia for the past on the other, there is no limit to appropriate subject matter to write about. Bone up on your research, warm up your pen, and you, too, can earn a little spending money!

Pitch your idea to the editor at [mtditor@grove.net](mailto:mtditor@grove.net) or call 828-837-9200 and ask for Rachel. Writer's Guidelines are available on the MT homepage at [www.grove-ent.com](http://www.grove-ent.com), or for an SASE.

## FREQUENCIES

0300-0400	Anguilla, Caribbean Beacon	6090am				0300-0400	UK, BBC African Service	3255af	6005af	6190af	9600af
0300-0400	Australia, Radio	9660pa	12080as	13605pa	15240pa	0300-0400	UK, BBC Asian Service	11730af			
		15415as	15510pa	17750as	17795pa			9605as	15310as	15360as	17790as
0300-0400 vl	Australia, VL8K Katherine	5025do				0300-0330	UK, BBC World Service	21660as			
0300-0400 vl	Australia, VL8T Tent Crk	4910do						5970sa	5975am	6175na	6195eu
0300-0400	Australia, Defense Forces R	15635as				0300-0400	Ukraine, R Ukraine Intl	9410eu	9895am	11760me	12095me
0300-0330 mtwhf	Canada, Can Forces Net	6155ca	9755ca	9780ca				5905eu	6020eu	7410eu	9550na
0300-0400 vl	Canada, CBC N Quebec Svc	9625do				0300-0400	USA, KAIJ Dallas TX	12040na	13590na		
0300-0400	Canada, CFRX Toronto	6070do				0300-0400	USA, KTVN Salt Lk City UT	5810am	9815am		
0300-0400	Canada, CFVP Calgary	6030do				0300-0400	USA, KVOH Los Angeles CA	7510am			
0300-0400	Canada, CHNX Halifax	6130do				0300-0400	USA, KWHR Naalehu HI	9975am			
0300-0400	Canada, CKZN St John's	6160do				0300-0400	USA, Voice of America	17510as	17555pa		
0300-0400	Canada, CKZU Vancouver	6160do						6080af	6115af	7105af	7280af
0300-0400	China, China Radio Intl	9690na						7290af	7340af	9575af	9885af
0300-0400	Costa Rica, RF Peace Intl	7385am	15050am			0300-0330 smtwh	USA, Voice of America	4960af			
0300-0305	Croatia, Croatian Radio	9925na				0300-0400	USA, WEWN Birmingham AL	5825eu			
0300-0400	Cuba, Radio Havana	6000na	9820na	9830na		0300-0400	USA, WGTG McCaysville GA	5085am			
0300-0327	Czech Rep, Radio Prague	7345na	9435na			0300-0400	USA, WHRA Greenbush ME	9400me			
0300-0400	Ecuador, HCJB	9745am	12015na	21455am		0300-0400	USA, WHRI Noblesville IN	5745am	7315am		
0300-0330	Egypt, Radio Cairo	9475na				0300-0400	USA, WINB Red Lion PA	11950am			
0300-0350	Germany, Deutsche Welle	6085na	6145na	6185na	9535na	0300-0400	USA, WJCR Upton KY	7490na	13595na		
		9640na				0300-0400	USA, WMLK Bethel PA	9465am			
0300-0400	Guatemala, Radio Cultural	3300do				0300-0400	USA, WRMI/R Miami Intl	9955am			
0300-0400 irreg	Iraq, Radio Iraq Intl	11785eu				0300-0400	USA, WRNO New Orleans LA	7395am			
0300-0400	Ireland, Unt Christian BC	6200do				0300-0400	USA, WSHB Cypress Crk SC	5850na			
0300-0400 as/vl	Italy, IRRS	7120va				0300-0400	USA, WWCR Nashville TN	3215am	5070am	5935am	7435am
0300-0400	Japan, R Japan/NHK World	17685pa	17825ca	17855as		0300-0400	USA, WYFR Okeechobee FL	6065na	9505na		
0300-0400 vl	Kenya, Kenya Broadc Corp	4885do	4935do	6150do		0300-0310	Vatican State, Vatican R	7305ca	9605am		
0300-0400 vl	Lesotho, Radio Lesotho	4800do				0300-0400 vl	Zambia, R Zambia/ZNBC 1	4910do			
0300-0400	Malaysia, Radio	7295do				0300-0400 vl	Zambia, R Zambia/ZNBC 2	6165do			
0300-0330 mtwhf	Mexico, Radio Mexico Intl	9705na				0300-0400 vl	Zimbabwe, Zimbabwe BC	3396do			
0300-0325	Moldova, R Moldova Intl	7520na				0310-0340	Vatican State, Vatican R	7360af	9660af		
0300-0325	Netherlands, Radio	9855as	11655as			0330-0357	Czech Rep, Radio Prague	9480va	11600as		
0300-0400	New Zealand, R NZ Intl	17675pa				0330-0400	Sweden, Radio	9475na	11665na		
0300-0400 vl	Papua New Guinea, NBC	9675do				0330-0355	UAE, Radio Dubai	11945na	12005na	13675na	15400na
0300-0400	Russia, Voice of Russia WS	9665na	12000na	12050na	13640na			21485na			
		13665na	15180na	15425na	15455na	0330-0400	UK, BBC African Service	9610af			
		15595na				0330-0400	UK, BBC Asian Service	11955as	15280as	15310as	
0300-0330	S Africa, Channel Africa	5955af				0330-0400	UK, BBC World Service	5975am	6175na	9895am	11760me
0300-0400	Singapore, R Corp Singapore	6150do						12095me			
0300-0400	Sri Lanka, Sri Lanka BC	9730as	15425as			0330-0400 s	UK, BBC World Service	6180eu	6195eu	9410eu	
0300-0400	Taiwan, Radio Taipei Intl	5950na	9680na	11745as	11825as	0330-0400	Vietnam, Voice of	5905am			
		15345as				0340-0350	Greece, Voice of	7450na	9375na	9420na	11645na
0300-0330	Thailand, Radio	9655am	11905am	15395na		0345-0400	Burundi, Radio Nationale	6140do			
0300-0400	Turkey, Voice of	7270as	9655va	17705as		0345-0400	Tajikistan, Radio	11620as			
0300-0315 mtwhf	Uganda, Radio	4976do				0345-0400 as	Uganda, Radio	4976do			
						0356-0400	Zambia, Christian Voice	3330af	6065af		

## SELECTED PROGRAMS

### Sundays

- 0300 Japan, NHK/Radio: News. See S 0000.
- 0300 KWHR (Angel 3): Whole Truth Broadcast. Bishop Rapha.
- 0300 KWHR (Angel 4): UPI News. See S 0000.
- 0300 WHRA (Angel 5): Turn Your Radio On. Bill Brasier plays southern gospel music.
- 0300 WHRI (Angel 1): UPI News. See S 0000.
- 0300 WHRI (Angel 2): Bible Truth Ministries. Larry Phillips.
- 0305 KWHR (Angel 4): Adventures in Odyssey. Lively children's dramas from the "Focus on the Family" team.
- 0305 WHRI (Angel 1): Music. See S 0005.
- 0310 Japan, NHK/Radio: Hello from Tokyo. See S 0010.
- 0330 KWHR (Angel 4): DXing with Cumbre. A what's-on-the-air program hosted by Marie Lamb.
- 0330 WHRI (Angel 2): Voice of Protestant America. Current events issues which relate to Protestantism.

### Mondays

- 0300 Japan, NHK/Radio: News. See S 0000.
- 0300 KWHR (Angel 3): The Sword of the Spirit. Mike Keyes evangelizes from Tucson, Arizona.
- 0300 KWHR (Angel 4): UPI News. See S 0000.
- 0300 WHRA (Angel 5): Music. See S 0005.
- 0300 WHRI (Angel 1&2): UPI News. See S 0000.
- 0305 KWHR (Angel 4): Music. See S 0005.
- 0305 WHRI (Angel 1): Turn Your Radio On. See S 0300.
- 0305 WHRI (Angel 2): For the People (repeat). Chuck Harder is back with his old talk radio show.
- 0315 Japan, NHK/Radio: Top News Asia. The most important stories from other Asian media organizations are summarized in a new 10-minute format.
- 0325 Japan, NHK/Radio: Music Reflections. Music from around the world which shares a common theme.

- 0330 KWHR (Angel 3): Day of Decision. Bob Roman evangelizes from Texas.

### Tuesdays

- 0300 Japan, NHK/Radio: News. See S 0000.
- 0300 KWHR (Angel 3&4): UPI News. See S 0000.
- 0300 WHRA (Angel 5): Bible Pathway. See M 0400.
- 0300 WHRI (Angel 1&2): UPI News. See S 0000.
- 0305 KWHR (Angel 3&4): Music. See S 0005.
- 0305 WHRA (Angel 5): Music. See S 0005.
- 0305 WHRI (Angel 1): Music. See S 0005.
- 0307 WHRI (Angel 2): For the People (repeat). See M 0305.
- 0315 Japan, NHK/Radio: Top News Asia. See M 0315.
- 0325 Japan, NHK/Radio: Enjoy Japanese. Learn and practice the Japanese language.

### Wednesdays

- 0300 Japan, NHK/Radio: News. See S 0000.
- 0300 KWHR (Angel 3&4): UPI News. See S 0000.
- 0300 WHRA (Angel 5): Bible Pathway. See M 0400.
- 0300 WHRI (Angel 1&2): UPI News. See S 0000.
- 0305 KWHR (Angel 3&4): Music. See S 0005.
- 0305 WHRA (Angel 5): Music. See S 0005.
- 0305 WHRI (Angel 1): Music. See S 0005.
- 0307 WHRI (Angel 2): For the People (repeat). See M 0305.
- 0315 Japan, NHK/Radio: Top News Asia. See M 0315.
- 0325 Japan, NHK/Radio: Music Reflections. See M 0325.

### Thursdays

- 0300 Japan, NHK/Radio: News. See S 0000.
- 0300 KWHR (Angel 3&4): UPI News. See S 0000.
- 0300 WHRA (Angel 5): Bible Pathway. See M 0400.
- 0300 WHRI (Angel 1&2): UPI News. See S 0000.

- 0305 KWHR (Angel 3&4): Music. See S 0005.
- 0305 WHRA (Angel 5): Music. See S 0005.
- 0305 WHRI (Angel 1): Music. See S 0005.
- 0307 WHRI (Angel 2): For the People (repeat). See M 0305.
- 0315 Japan, NHK/Radio: Top News Asia. See M 0315.
- 0325 Japan, NHK/Radio: My Japan Diary. New program.

### Fridays

- 0300 Japan, NHK/Radio: News. See S 0000.
- 0300 KWHR (Angel 3&4): UPI News. See S 0000.
- 0300 WHRA (Angel 5): Bible Pathway. See M 0400.
- 0300 WHRI (Angel 1&2): UPI News. See S 0000.
- 0305 KWHR (Angel 3&4): Music. See S 0005.
- 0305 WHRA (Angel 5): Music. See S 0005.
- 0305 WHRI (Angel 1): Music. See S 0005.
- 0307 WHRI (Angel 2): For the People (repeat). See M 0305.
- 0315 Japan, NHK/Radio: Top News Asia. See M 0315.
- 0325 Japan, NHK/Radio: Music Beat. What people in Japan are listening to.

### Saturdays

- 0300 Japan, NHK/Radio: News. See S 0000.
- 0300 KWHR (Angel 3&4): UPI News. See S 0000.
- 0300 WHRA (Angel 5): Bible Pathway. See M 0400.
- 0300 WHRI (Angel 1&2): UPI News. See S 0000.
- 0305 KWHR (Angel 3&4): Music. See S 0005.
- 0305 WHRA (Angel 5): Music. See S 0005.
- 0305 WHRI (Angel 1): Music. See S 0005.
- 0307 WHRI (Angel 2): For the People (repeat). See M 0305.
- 0310 Japan, NHK/Radio: Weekend Break. See S 0510.

## FREQUENCIES

0400-0500	Anguilla, Caribbean Beacon	6090am				0400-0430	UK, BBC World Service	3955eu	5975am	6175na	6180eu
0400-0500	Australia, Radio	9660pa	12080as	13605as	15240pa			6195eu	9410eu	9895am	11760me
		15415as	15510pa	17750as	17795pa			12095eu	15575as	17640eu	
0400-0500 vl	Australia, VL8K Katherine	5025do				0400-0500	USA, KAIJ Dallas TX	5810am			
0400-0500 vl	Australia, VL8T Tent Crk	4910do				0400-0500	USA, KTVN Salt Lk City UT	7510am			
0400-0500	Australia, Defense Forces R	15635as				0400-0500	USA, KVOH Los Angeles CA	9975am			
0400-0430 a	Belarus, R Belarus Intl	7210eu	11960eu			0400-0500	USA, KWHR Naalehu HI	17510as	17555as		
0400-0500	Canada, CBC N Quebec Svc	9625do				0400-0500	USA, Voice of America	6080af	7170af	7265af	7280af
0400-0500	Canada, CFRX Toronto	6070do						7290af	9575af	9885af	11965me
0400-0500	Canada, CFVP Calgary	6030do						15205va			
0400-0500	Canada, CHNX Halifax	6130do				0400-0500	USA, WEWN Birmingham AL	5825eu			
0400-0500	Canada, CKZN St John's	6160do				0400-0500	USA, WGTG McCaysville GA	5085am			
0400-0500	Canada, CKZU Vancouver	6160do				0400-0500	USA, WHRA Greenbush ME	9400me			
0400-0429	Canada, R Canada Intl	9715me	11835me	11975me		0400-0500	USA, WHRI Noblesville IN	5745am	7315am		
0400-0500	China, China Radio Intl	9560na	9730am			0400-0500	USA, WINB Red Lion PA	11950am			
0400-0500	Costa Rica, RF Peace Intl	7385am	15050am			0400-0500	USA, WJCR Upton KY	7490na	13595na		
0400-0500	Cuba, Radio Havana	6000na	9820na	9830na		0400-0500	USA, WMLK Bethel PA	9465am			
0400-0500	Ecuador, HCJB	9745na	12015am	21455am		0400-0500	USA, WRMI/R Miami Intl	9955am			
0400-0450	Germany, Deutsche Welle	5990af	6015af	7225af	9565af	0400-0500	USA, WRNO New Orleans LA	7395am			
		11765af				0400-0500	USA, WSHB Cypress Crk SC	7535eu	9840af		
0400-0500 vl	Guatemala, Radio Cultural	3300do				0400-0500	USA, WWCR Nashville TN	3210am	5070am	5935na	7435am
0400-0500	Ireland, Unt Christian BC	6200do				0400-0500	USA, WYFR Okeechobee FL	6065na	9505na	9985va	
0400-0415	Israel, Kol Israel	9435eu	11605eu	17535na		0400-0500	Zambia, Christian Voice	3330af	6065af		
0400-0500 as/vl	Italy, IRRS	7120va				0400-0500 vl	Zambia, R Zambia/ZNBC 1	4910do			
0400-0500 vl	Kenya, Kenya Broadc Corp	4885do	4935do	6150do		0400-0500 vl	Zambia, R Zambia/ZNBC 2	6165do			
0400-0500	Malaysia, Radio	7295do				0400-0500 vl	Zimbabwe, Zimbabwe BC	3396do			
0400-0500 vl	Malaysia, RTM Kuching	7160do				0415-0500 vl/m-f	Malawi, MBC	5993do			
0400-0430 mtwhf	Mexico, Radio Mexico Intl	9705na				0425-0440 vl	Italy, RAI Intl	5975af	7270af		
0400-0425	Moldova, R Moldova Intl	7520na				0425-0500	Nigeria, FRCN/Radio	3326do	4770do	4990do	
0400-0458	New Zealand, R NZ Intl	17675pa				0430-0500	Austria, R Austria Intl	6155eu	13730eu		
0400-0430 m	Norway, Radio Norway Intl	11990na				0430-0500 wf	Belarus, R Belarus Intl	7210eu	11960eu		
0400-0500 vl	Papua New Guinea, NBC	9675do				0430-0500 vl	Lesotho, Radio Lesotho	4800do			
0400-0500	Romania, R Romania Intl	9570na	11940na	15335as	17720as	0430-0500	Netherlands, Radio	6165na	9590na		
0400-0500	Russia, Voice of Russia WS	9665na	12000na	12050na	13645na	0430-0500	Serbia, Radio Yugoslavia	6100eu	7130eu		
		13665na	15180na	15455na	15595na	0430-0500	Swaziland, Trans World R	3200af	4775af		
0400-0430	S Africa, Channel Africa	5955af				0430-0500	Switzerland, Swiss R Intl	9885na	9905na		
0400-0500	Singapore, R Corp Singapore	6150do				0430-0500	UK, BBC World Service	5975am	6175am	11760me	15575as
0400-0430	Sri Lanka, Sri Lanka BC	9730as	15425as					17640me			
0400-0430	Switzerland, Swiss R Intl	5840eu	6165eu	9885am	9905am	0430-0500 as	UK, BBC World Service	3955eu	6180eu	6195eu	9410eu
0400-0415	Uganda, Radio	4976do						12095eu			
0400-0500	UK, BBC African Service	3255af	6005af	6190af	7160af	0455-0500	Malaysia, Voice of	6175as	9750as	15295au	
		9600af	15420af			0455-0500	Nigeria, Voice of	7255af	15120af		
0400-0500	UK, BBC Asian Service	9605as	11955as	15280as	15310as	0459-0500	New Zealand, R NZ Intl	11690pa			
		17790as	21660as								

## SELECTED PROGRAMS

## Sundays

- 0400 Canada, RCI Montreal: RCI News. See S 0100.  
 0400 KWHR (Angel 3): Turn Your Radio On. See S 0300.  
 0400 KWHR (Angel 4): UPI News. See S 0000.  
 0400 WHRA (Angel 5): Music. See S 0005.  
 0400 WHRI (Angel 1): UPI News. See S 0000.  
 0403 WHRI (Angel 1): Turn Your Radio On. See S 0300.  
 0405 Canada, RCI Montreal: Venture Canada. See S 0107.  
 0405 KWHR (Angel 4): Music. See S 0005.  
 0430 WHRI (Angel 2): DXing with Cumbre. See S 0330.

## Mondays

- 0400 Canada, RCI Montreal: RCI News. See S 0100.  
 0400 KWHR (Angel 4): UPI News. See S 0000.  
 0400 WHRA (Angel 5): Bible Pathway. Rick Hash with five minutes of Bible readings.  
 0400 WHRI (Angel 1): Bob Enyart (live). Bob takes listener phone calls about everyday Christian topics.  
 0400 WHRI (Angel 2): The Prophecy Club. Stan Johnson discusses bible prophecy from Topeka, Kansas.  
 0405 KWHR (Angel 3&4): Music. See S 0005.  
 0405 WHRA (Angel 5): Music. See S 0005.  
 0407 Canada, RCI Montreal: The Mailbag. See S 1337.  
 0430 KWHR (Angel 4): Lester Sumrall Teaching Series. See S 1400.  
 0430 WHRI (Angel 2): The Hour of Courage. Ron Wilson talks politics and the precious metals market.

## Tuesdays

- 0400 Canada, RCI Montreal: RCI News. See S 0100.  
 0400 KWHR (Angel 4): UPI News. See S 0000.  
 0400 WHRA (Angel 5): Bible Pathway. See M 0400.  
 0400 WHRI (Angel 1): Bob Enyart (live). See M 0400.  
 0400 WHRI (Angel 2): The Prophecy Club. See M 0400.  
 0405 KWHR (Angel 3&4): Music. See S 0005.  
 0405 WHRA (Angel 5): Music. See S 0005.  
 0411 Canada, RCI Montreal: Spectrum. See M 1341.

- 0430 KWHR (Angel 4): Lester Sumrall Teaching Series. See S 1400.  
 0430 WHRI (Angel 2): The Hour of Courage. See M 0430.

## Wednesdays

- 0400 Canada, RCI Montreal: RCI News. See S 0100.  
 0400 KWHR (Angel 4): UPI News. See S 0000.  
 0400 WHRA (Angel 5): Bible Pathway. See M 0400.  
 0400 WHRI (Angel 1): Bob Enyart (live). See M 0400.  
 0400 WHRI (Angel 2): The Prophecy Club. See M 0400.  
 0405 KWHR (Angel 3&4): Music. See S 0005.  
 0405 WHRA (Angel 5): Music. See S 0005.  
 0411 Canada, RCI Montreal: Spectrum. See M 1341.  
 0430 KWHR (Angel 4): Lester Sumrall Teaching Series. See S 1400.  
 0430 WHRI (Angel 2): The Hour of Courage. See M 0430.

## Thursdays

- 0400 Canada, RCI Montreal: RCI News. See S 0100.  
 0400 KWHR (Angel 4): UPI News. See S 0000.  
 0400 WHRA (Angel 5): Bible Pathway. See M 0400.  
 0400 WHRI (Angel 1): Bob Enyart (live). See M 0400.  
 0400 WHRI (Angel 2): The Prophecy Club. See M 0400.  
 0405 KWHR (Angel 3&4): Music. See S 0005.  
 0405 WHRA (Angel 5): Music. See S 0005.  
 0411 Canada, RCI Montreal: Spectrum. See M 1341.  
 0430 KWHR (Angel 4): Lester Sumrall Teaching Series. See S 1400.  
 0430 WHRI (Angel 2): The Hour of Courage. See M 0430.  
 0454 Radio Netherlands: Documentary. Philippines (Parts 1 and 2) (4th/11th). See W 1154.  
 0454 Radio Netherlands: Documentary. The High C's (Parts 1 and 2) (19th/26th). See A 0154.

## Fridays

- 0400 Canada, RCI Montreal: RCI News. See S 0100.  
 0400 KWHR (Angel 4): UPI News. See S 0000.  
 0400 WHRA (Angel 5): Bible Pathway. See M 0400.  
 0400 WHRI (Angel 1): Bob Enyart (live). See M 0400.  
 0400 WHRI (Angel 2): The Prophecy Club. See M 0400.

- 0405 KWHR (Angel 3): The Pat Boone Show. See S 0205.  
 0405 KWHR (Angel 4): Music. See S 0005.  
 0405 WHRA (Angel 5): Music. See S 0005.  
 0411 Canada, RCI Montreal: Spectrum. See M 1341.  
 0430 KWHR (Angel 4): Lester Sumrall Teaching Series. See S 1400.  
 0430 WHRI (Angel 2): The Hour of Courage. See M 0430.

## Saturdays

- 0400 Canada, RCI Montreal: RCI News. See S 0100.  
 0400 KWHR (Angel 3): Gospel Crusade Ministries. See S 0630.  
 0400 KWHR (Angel 4): UPI News. See S 0000.  
 0400 WHRA (Angel 5): Music. See S 0005.  
 0400 WHRI (Angel 1): Bob Enyart. See M 0400.  
 0400 WHRI (Angel 2): The Prophecy Club. See M 0400.  
 0405 KWHR (Angel 4): Music. See S 0005.  
 0411 Canada, RCI Montreal: Spectrum. See M 1341.  
 0430 KWHR (Angel 3): Apostolic Assembly. Lonnie Wollard preaches from Milltown, Connecticut.  
 0430 WHRI (Angel 2): The Hour of Courage. See M 0430.

HAUSER'S HIGHLIGHTS  
NORWAY: R NORWAY INT'L

English to NAm, Sun and UT Mon only  
for April and perhaps rest of summer:

1300	15640
1600	17640
1800	15705
2300	13805
0200	11990
0400	11990

(via Joe Hanlon, Bob Thomas)

## FREQUENCIES

0500-0600	Anguilla, Caribbean Beacon	6090am				0500-0530	S Africa, Channel Africa	9525af		
0500-0600	Australia, Radio	9660pa	12080as	13605pa	15240pa	0500-0600	Singapore, R Corp Singapore	6150do		
		15510pa	17795pa			0500-0600	Spain, R Exterior Espana	6055am		
0500-0600 vl	Australia, VL8K Katherine	5025do				0500-0515	Uganda, Radio	4976do		
0500-0600 vl	Australia, VL8T Tent Crk	4910do				0500-0600	UK, BBC African Service	3255af	6005af	6190af 7160af
0500-0600	Australia, Defense Forces R	15635as						9600af	15420af	17885af
0500-0600 vl	Cameroon, Radio Cameroon	4850do				0500-0600	UK, BBC Asian Service	9740as	11955as	15280as 15310as
0500-0600	Canada, CBC N Quebec Svc	9625do						15360as	17760as	17790as 21660as
0500-0600	Canada, CFRX Toronto	6070do				0500-0600	UK, BBC World Service	3955eu	5975am	6175am 6180eu
0500-0600	Canada, CFVP Calgary	6030do						6195eu	9410eu	11760me 12095eu
0500-0600	Canada, CHNX Halifax	6130do						15575eu	17640me	
0500-0600	Canada, CKZU Vancouver	6160do				0500-0600	USA, KAIJ Dallas TX	5810am	9815am	
0500-0529 mtwhf	Canada, R Canada Intl	7295eu	9595eu	11835af	15430af	0500-0600	USA, KTNB Salt Lk City UT	7510am		
0500-0600	China, China Radio Intl	9560na				0500-0600	USA, KWHR Naalehu HI	17555pa	17780as	
0500-0600	Costa Rica, RF Peace Intl	7385am	15050am			0500-0600	USA, Voice of America	5970af	6035af	6080af 7170eu
0500-0600	Cuba, Radio Havana	6180na	9820na	9830na				7195af	9630af	11965me 12080af
0500-0600	Ecuador, HCJB	9745na	12015na	21455am				15205eu		
0500-0550	Germany, Deutsche Welle	6045na	6185na	9615am	11810na	0500-0600	USA, WEWN Birmingham AL	5825eu	7405na	
0500-0600	Ireland, Unt Christian BC	6200do				0500-0600	USA, WGTG McCaysville GA	5085na		
0500-0600 vl	Italy, IRRS	3985va				0500-0600	USA, WHRA Greenbush ME	11565af		
0500-0600	Japan, R Japan/NHK World	6110na	7230eu	9835na	11715as	0500-0600	USA, WHRI Noblesville IN	5745am	7315am	
		11760as	11840as	11850pa	15230pa	0500-0600	USA, WINB Red Lion PA	11950am		
		17810as				0500-0600	USA, WJCR Upton KY	7490na	13595na	
0500-0530 vl	Lesotho, Radio Lesotho	4800do				0500-0600	USA, WMLK Bethel PA	9465am		
0500-0600	Liberia, Radio Veritas	5470do				0500-0600	USA, WRMI/R Miami Intl	9955am		
0500-0600	Liberia, Star Radio	3400do				0500-0600	USA, WRNO New Orleans LA	7395am		
0500-0600	Liberia, LCN/R Liberia Int	5100do				0500-0600	USA, WSHB Cypress Crk SC	7535eu	9835af	
0500-0510 vl-m-f	Malawi, MBC	5993do				0500-0600	USA, WWCR Nashville TN	2390am	3210am	5070am 5935am
0500-0600	Malaysia, Radio	7295do				0500-0600	USA, WYFR Okeechobee FL	5985na	9985eu	11580af
0500-0600 vl	Malaysia, RTM Kuching	4895do	7160do			0500-0520	Vatican State, Vatican R	5883eu	7250eu	9660af 11625af
0500-0600	Malaysia, Voice of	6175as	9750as	15295au				15570af		
0500-0530 s	Malta, VO Mediterranean	17570au				0500-0600	Zambia, Christian Voice	3330af	6065af	
0500-0600 vl	Namibia, NBC	3270do	3290do			0500-0530 vl	Zambia, R Zambia/ZNBC 1	4910do		
0500-0525	Netherlands, Radio	6165na	9590na			0500-0600 vl	Zambia, R Zambia/ZNBC 2	6165do		
0500-0600	New Zealand, R NZ Intl	11690pa				0500-0600 vl	Zimbabwe, Zimbabwe BC	3396do		
0500-0505	Nigeria, FRCN/Radio	3326do	4770do	4990do		0505-0600	Swaziland, Trans World R	3200af	4775af	9500af
0500-0600	Nigeria, Voice of	7255af	15120af			0520-0530	Vatican State, Vatican R	9660af	11625af	15570af
0500-0557	North Korea, R Pyongyang	3560eu	11710eu	13790eu		0525-0600	Ghana, Ghana Broadc Corp	3366do	4915do	
0500-0600 vl	Papua New Guinea, NBC	9675do				0530-0600	Austria, R Austria Intl	6015na		
0500-0600	Russia, Voice of Russia WS	9450au	17495au	17665au 21760au		0530-0600	Switzerland, Swiss R Intl	5840eu	6165eu	
		21790au				0530-0600	Thailand, Radio	9655eu	11905eu	15115eu
0500-0530	S Africa, AWR Africa	6000af	6100af			0530-0600 vl	Zambia, R Zambia/ZNBC 1	4910do		

## SELECTED PROGRAMS

## Sundays

- 0500 KWHR (Angel 3): Breakthrough. Rod Parsley conducts services from The World Harvest Church in Columbus, OH.
- 0500 KWHR (Angel 4): UPI News. See S 0000.
- 0500 WHRI (Angel 1&2): The Joy of Living Broadcast. Ms. Hurst and Ms. Smith evangelize with words and song.
- 0505 KWHR (Angel 4): Music. See S 0005.
- 0515 WHRI (Angel 1): Heartfelt Ministries. Advice from the heart.
- 0515 WHRI (Angel 2): Music. See S 0005.
- 0530 WHRI (Angel 1&2): The Mercies of God Radio Broadcast. Pastor Peter Notier from Michigan preaches mercy for lost sinners.

## Mondays

- 0500 KWHR (Angel 3): Shepherd's Chapel. Arnold Murray's international outreach.
- 0500 KWHR (Angel 4): Bob Enyart (live). See M 0400.
- 0500 WHRA (Angel 5): Faith Seminar of the Air. Kenneth Hagin evangelizes from Tulsa, Oklahoma.
- 0500 WHRI (Angel 1): John Hagee Today. Evangelizing by John Hagee of the Cornerstone Church in San Antonio, TX.
- 0500 WHRI (Angel 2): Blow the Trumpet in Zion. Paul Sorko-Ram.
- 0505 WHRI (Angel 2): In Touch. See S 1200.
- 0515 WHRA (Angel 5): The Radio Bible Hour. Dr. J. Harold Smith has been preaching on the radio since 1935.
- 0530 WHRA (Angel 5): Focus on the Word. Anthony Buzzard from the New Covenant Baptist Church.
- 0530 WHRI (Angel 1): In Touch. See S 1200.
- 0545 WHRA (Angel 5): Moments in Bible Prophecy. Raymond Shockley teaches from the Book of Revelations.
- 0555 WHRI (Angel 1&2): Family Forum. Jay Kessler.

## Tuesdays

- 0500 KWHR (Angel 3): Shepherd's Chapel. See M 0500.
- 0500 KWHR (Angel 4): Bob Enyart (live). See M 0400.
- 0500 WHRA (Angel 5): Faith Seminar of the Air. See M 0500.
- 0500 WHRI (Angel 1): John Hagee Today. See M 0500.

- 0500 WHRI (Angel 2): Blow the Trumpet in Zion. See M 0500.
- 0505 WHRI (Angel 2): In Touch. See S 1200.
- 0515 WHRA (Angel 5): The Radio Bible Hour. See M 0515.
- 0530 WHRA (Angel 5): Focus on the Word. See M 0530.
- 0530 WHRI (Angel 1): In Touch. See S 1200.
- 0545 WHRA (Angel 5): Moments in Bible Prophecy. See M 0545.
- 0555 WHRI (Angel 1&2): Family Forum. See M 0555.

## Wednesdays

- 0500 KWHR (Angel 3): Shepherd's Chapel. See M 0500.
- 0500 KWHR (Angel 4): Bob Enyart (live). See M 0400.
- 0500 WHRA (Angel 5): Faith Seminar of the Air. See M 0500.
- 0500 WHRI (Angel 1): John Hagee Today. See M 0500.
- 0500 WHRI (Angel 2): Blow the Trumpet in Zion. See M 0500.
- 0505 WHRI (Angel 2): In Touch. See S 1200.
- 0515 WHRA (Angel 5): The Radio Bible Hour. See M 0515.
- 0530 WHRA (Angel 5): Focus on the Word. See M 0530.
- 0530 WHRI (Angel 1): In Touch. See S 1200.
- 0545 WHRA (Angel 5): Moments in Bible Prophecy. See M 0545.
- 0555 WHRI (Angel 1&2): Family Forum. See M 0555.

## Thursdays

- 0500 KWHR (Angel 3): Shepherd's Chapel. See M 0500.
- 0500 KWHR (Angel 4): Bob Enyart (live). See M 0400.
- 0500 WHRA (Angel 5): Faith Seminar of the Air. See M 0500.
- 0500 WHRI (Angel 1): John Hagee Today. See M 0500.
- 0500 WHRI (Angel 2): Blow the Trumpet in Zion. See M 0500.
- 0505 WHRI (Angel 2): In Touch. See S 1200.
- 0515 WHRA (Angel 5): The Radio Bible Hour. See M 0515.
- 0530 WHRA (Angel 5): Focus on the Word. See M 0530.
- 0530 WHRI (Angel 1): In Touch. See S 1200.
- 0545 WHRA (Angel 5): Moments in Bible Prophecy. See M 0545.
- 0555 WHRI (Angel 1&2): Family Forum. See M 0555.

## Fridays

- 0500 KWHR (Angel 3): Shepherd's Chapel. See M 0500.
- 0500 KWHR (Angel 4): Bob Enyart (live). See M 0400.
- 0500 WHRA (Angel 5): Faith Seminar of the Air. See M 0500.
- 0500 WHRI (Angel 1): John Hagee Today. See M 0500.

- 0500 WHRI (Angel 2): Blow the Trumpet in Zion. See M 0500.
- 0505 WHRI (Angel 2): In Touch. See S 1200.
- 0515 WHRA (Angel 5): The Radio Bible Hour. See M 0515.
- 0530 WHRA (Angel 5): Focus on the Word. See M 0530.
- 0530 WHRI (Angel 1): In Touch. See S 1200.
- 0545 WHRA (Angel 5): Moments in Bible Prophecy. See M 0545.
- 0555 WHRI (Angel 1&2): Family Forum. See M 0555.

## Saturdays

- 0500 KWHR (Angel 3): Thinking Like God. Hart Armstrong preaches from The Book of Revelations.
- 0500 KWHR (Angel 4): Bob Enyart (live). See M 0400.
- 0500 WHRA (Angel 5): The Call to Worship. See S 0600.
- 0500 WHRI (Angel 1&2): DXing with Cumbre. See S 0330.
- 0530 KWHR (Angel 3): Walking in Power. See S 1500.
- 0530 WHRA (Angel 5): The Mercies of God Radio Broadcast. See S 0530.
- 0530 WHRI (Angel 1): Christian Country Music. See S 1430.
- 0530 WHRI (Angel 2): A Temple of Jesus Christ. See S 0030.

## PROPAGATION FORECASTING

JACQUES D'AVIGNON, VE3VIA  
248 TOWERHILL ROAD  
PETERBOROUGH, ON K9H 7N1  
CANADA

DISTRIBUTOR ASAPS PROPAGATION SOFTWARE  
E-MAIL: MONITOR@RAC.CA

## FREQUENCIES

0600-0700	Anguilla, Caribbean Beacon	6090am				0600-0700	UK, BBC Asian Service	7145pa	9740as	11955pa	15310as
0600-0700	Australia, Radio	9660pa	11880pa	12080as	13605pa	0600-0700	UK, BBC World Service	15360as	17760as	17790as	21660as
		15240pa	15415as	15510pa	17750as			5975am	6175am	6180eu	6195eu
0600-0700 vl	Australia, VL8K Katherine	5025do						7325eu	9410eu	11760me	12095eu
0600-0700 vl	Australia, VL8T Tent Crk	4910do				0600-0700	USA, KAIJ Dallas TX	5810am	9815am		
0600-0700 vl	Canada, CBC N Quebec Svc	9625do				0600-0700	USA, KTBN Salt Lk City UT	7510am			
0600-0700	Canada, CFRX Toronto	6070do				0600-0700	USA, KVOH Los Angeles CA	9975am			
0600-0700	Canada, CFVP Calgary	6030do				0600-0700	USA, KWHR Naalehu HI	17555pa	17780as		
0600-0700	Canada, CHNX Halifax	6130do				0600-0630	USA, Voice of America	5970af	6035af	6080af	7170eu
0600-0700	Canada, CKZU Vancouver	6160do						7195af	9630af	9680af	11805af
0600-0700	Costa Rica, RF Peace Intl	7385am	15050am					11965me	11995af	12080af	15205va
0600-0700	Cuba, Radio Havana	6180na	9820na	9830na		0600-0700	USA, WEWN Birmingham AL	5825eu	7405na		
0600-0700	Ecuador, HCJB	9745na	12015na	21455am		0600-0700	USA, WHRA Greenbush ME	11565af			
0600-0650	Germany, Deutsche Welle	11915af	13790af	15185af	17820as	0600-0700	USA, WHRI Noblesville IN	5745am	7315am		
		17860af	21680me			0600-0700	USA, WJCR Upton KY	7490na	13595na		
0600-0700	Germany, Overcomer Ministr	9500pa				0600-0700	USA, WMLK Bethel PA	9465am			
0600-0615	Ghana, Ghana Broadc Corp	3366do	4915do			0600-0700	USA, WRMI/R Miami Intl	9955am			
0600-0700	Ireland, Unt Christian BC	6200do				0600-0700	USA, WRNO New Orleans LA	7395am			
0600-0630 vl	Italy, IRRS	3985va				0600-0700	USA, WSHB Cypress Crk SC	7535eu	9835af		
0600-0700	Japan, R Japan/NHK World	5975eu	7230eu	9835na	11740as	0600-0700	USA, WWCR Nashville TN	2390am	3210am	5070am	5935am
		11840as	11850pa	17810as		0600-0700	USA, WYFR Okeechobee FL	5985am	7355va		
0600-0700 vl	Kiribati, Radio	9810do				0600-0700	Yemen, Radio Aden	9780do			
0600-0700	Liberia, Radio Veritas	3450do				0600-0700	Zambia, Christian Voice	3330af	6065af		
0600-0700	Liberia, Star Radio	3400do				0600-0700 vl	Zambia, R Zambia/ZNBC 1	7220do			
0600-0700	Liberia, LCN/R Liberia Int	5100do				0600-0700 vl	Zambia, R Zambia/ZNBC 2	6165do			
0600-0700	Malaysia, Radio	7295do				0600-0700 vl	Zimbabwe, Zimbabwe BC	5975do			
0600-0700 vl	Malaysia, RTM Kuching	4895do	7160do			0605-0700	Swaziland, Trans World R	4775af	6100af	9500af	
0600-0700	Malaysia, Voice of	6175as	9750as	15295au		0630-0700	Finland, YLE/R Finland	11945as	17830as		
0600-0700 vl	Namibia, NBC	3270do	3290do			0630-0700 as/vl	Italy, IRRS	7120va			
0600-0700 mtwhf	New Zealand, R NZ Intl	11690pa				0630-0700 smtwha	Malta, VO Mediterranean	9660eu			
0600-0658 as	New Zealand, R NZ Intl	11690pa				0630-0700	USA, Voice of America	7170eu	11805af	11965me	15205eu
0600-0630	Nigeria, FRNC/Radio	3326do	4770do	4990do		0630-0700 as	USA, Voice of America	5970af	6035af	6080af	7195af
0600-0700	Nigeria, Voice of	7255af	15120af					9630af	11995af	12080af	
0600-0630 m	Norway, Radio Norway Intl	7180eu	9590eu			0630-0645	Vatican State, Vatican R	11625af	13765af	15570af	
0600-0700 vl	Papua New Guinea, NBC	9675do				0630-0645 mtwhfa	Vatican State, Vatican R	4005eu	5883eu	7250eu	9645eu
0600-0700	Romania, R Romania Intl	9510na	11940na					11740eu	15595eu		
0600-0700	Russia, Voice of Russia WS	9450au	15490au	17495au	17665au	0640-0700	Romania, R Romania Intl	9550eu	9625eu	9665eu	11885eu
		21760au	21790au			0645-0655 s	Albania, TWR Tirana	9685eu			
0600-0630	S Africa, Channel Africa	11900af				0645-0655 as	Monaco, Trans World Radio	9755eu			
0600-0630	S Africa, Trans World R	11735af				0645-0700	Vatican State, Vatican R	11625af	13765af	15570af	
0600-0610	Sierra Leone, SLBS	3316do				0655-0700	Albania, TWR Tirana	9685eu			
0600-0700	Singapore, R Corp Singapore	6150do				0655-0700 mtwhf	Monaco, Trans World Radio	9755eu			
0600-0700 vl	Solomon Islands, SIBC	5020do				0658-0700 as	New Zealand, R NZ Intl	6100pa			
0600-0605	Swaziland, Trans World R	4775af	9500af	6190af	7160af						
0600-0700	UK, BBC African Service	6005af	6190af	7160af	9600af						
		11835af	11940af	15420af	17885af						

## SELECTED PROGRAMS

## Sundays

- 0600 Japan, NHK/Radio: News. See S 0000.  
 0600 KWHR (Angel 3): Witness of Power. Randy Brodhagen preaches.  
 0600 KWHR (Angel 4): UPI News. See S 0000.  
 0600 WHRA (Angel 5): Sipes Evangelism. John and Rosealie Sipes.  
 0600 WHRI (Angel 1&2): The Call to Worship. Bernie Timmerman with services from Zion Chapel, Holland, Michigan.  
 0605 KWHR (Angel 4): Music. See S 0005.  
 0610 Japan, NHK/Radio: Hello from Tokyo. See S 0010.  
 0630 KWHR (Angel 3): Taste God's Goodness. Lela Pendergrass teaches about the coming rapture.  
 0630 WHRA (Angel 5): Gospel Crusade Ministries. Scripture teachings by Roger Headrick and free bible correspondence courses.  
 0630 WHRI (Angel 1): Music. See S 0005.  
 0630 WHRI (Angel 2): The Voice of Power. RW Schambach preaches from Tyler, Texas.  
 0645 KWHR (Angel 3): Truth for the World. Churches of Christ spokesman Jim Dearman examines Scripture.

## Mondays

- 0600 Japan, NHK/Radio: News. See S 0000.  
 0600 KWHR (Angel 3&4): World Harvest. Steve Sumrall with a full hour of music and a ministry update.  
 0600 WHRA (Angel 5): World Harvest. See M 0600.  
 0600 WHRI (Angel 1&2): The Radio Bible Hour. See M 0515.  
 0615 Japan, NHK/Radio: Top News Asia. See M 0315.  
 0615 WHRI (Angel 1&2): Faith Seminar of the Air. See M 0500.  
 0625 Japan, NHK/Radio: Music Reflections. See M 0325.

- 0630 WHRI (Angel 1&2): Listen to Jesus. Clinton and Sarah Outerback from The Redeeming Love Christian Center of Nanuet, NY.  
 0645 WHRI (Angel 1&2): The Voice of Praise. Pastor Kenneth Ivey teaches from the word of God.

## Tuesdays

- 0600 Japan, NHK/Radio: News. See S 0000.  
 0600 KWHR (Angel 3&4): World Harvest. See M 0600.  
 0600 WHRA (Angel 5): World Harvest. See M 0600.  
 0600 WHRI (Angel 1&2): The Radio Bible Hour. See M 0515.  
 0615 Japan, NHK/Radio: Top News Asia. See M 0315.  
 0615 WHRI (Angel 1&2): Faith Seminar of the Air. See M 0500.  
 0625 Japan, NHK/Radio: Enjoy Japanese. See T 0325.  
 0630 WHRI (Angel 1&2): Listen to Jesus. See M 0630.  
 0645 WHRI (Angel 1&2): The Voice of Praise. See M 0645.

## Wednesdays

- 0600 Japan, NHK/Radio: News. See S 0000.  
 0600 KWHR (Angel 3&4): World Harvest. See M 0600.  
 0600 WHRI (Angel 5): World Harvest. See M 0600.  
 0600 WHRI (Angel 1&2): The Radio Bible Hour. See M 0515.  
 0615 Japan, NHK/Radio: Top News Asia. See M 0315.  
 0615 WHRI (Angel 1&2): Faith Seminar of the Air. See M 0500.  
 0625 Japan, NHK/Radio: Music Reflections. See M 0325.  
 0630 WHRI (Angel 1&2): Listen to Jesus. See M 0630.  
 0645 WHRI (Angel 1&2): The Voice of Praise. See M 0645.

## Thursdays

- 0600 Japan, NHK/Radio: News. See S 0000.  
 0600 KWHR (Angel 3&4): World Harvest. See M 0600.  
 0600 WHRA (Angel 5): World Harvest. See M 0600.  
 0600 WHRI (Angel 1&2): The Radio Bible Hour. See M 0515.

- 0615 Japan, NHK/Radio: Top News Asia. See M 0315.  
 0615 WHRI (Angel 1&2): Faith Seminar of the Air. See M 0500.  
 0625 Japan, NHK/Radio: My Japan Diary. See H 0325.  
 0630 WHRI (Angel 1&2): Listen to Jesus. See M 0630.  
 0645 WHRI (Angel 1&2): The Voice of Praise. See M 0645.

## Fridays

- 0600 Japan, NHK/Radio: News. See S 0000.  
 0600 KWHR (Angel 3&4): World Harvest. See M 0600.  
 0600 WHRA (Angel 5): World Harvest. See M 0600.  
 0600 WHRI (Angel 1&2): The Radio Bible Hour. See M 0515.  
 0615 Japan, NHK/Radio: Top News Asia. See M 0315.  
 0615 WHRI (Angel 1&2): Faith Seminar of the Air. See M 0500.  
 0625 Japan, NHK/Radio: Music Beat. See F 0325.  
 0630 WHRI (Angel 1&2): Listen to Jesus. See M 0630.  
 0645 WHRI (Angel 1&2): The Voice of Praise. See M 0645.

## Saturdays

- 0600 Japan, NHK/Radio: News. See S 0000.  
 0600 KWHR (Angel 3): The Banner of Truth Broadcast. Sponsored by the Free Reformed Churches of North America.  
 0600 KWHR (Angel 4): Turn Your Radio On. See S 0300.  
 0600 WHRA (Angel 5): Sipes Evangelism. See S 0600.  
 0600 WHRI (Angel 1): UPI News. See S 0000.  
 0600 WHRI (Angel 2): The Call to Worship. See M 0600.  
 0604 WHRI (Angel 1): Turn Your Radio On. See S 0300.  
 0610 Japan, NHK/Radio: Asian Weekly. See S 1410.  
 0630 KWHR (Angel 3): The Word of God Broadcast. Sister Polly preaches from the Knoxville House of Faith in Tennessee.  
 0630 WHRA (Angel 5): The Prophetic Voice Broadcast. A program from Gospel Truth Ministries of Cincinnati.  
 0630 WHRI (Angel 2): The Voice of Power. See S 0630.  
 0645 KWHR (Angel 3): Truth for the World. See S 0645.

## FREQUENCIES

0700-0800	Anguilla, Caribbean Beacon	6090am				0800-0820	Albania, TWR Tirana	9685eu			
0700-0800	Australia, Radio	9660pa	11880pa	12080as	13605pa	0800-0900	Anguilla, Caribbean Beacon	6090am			
		15240pa	15415as	15510pa	17750as	0800-0830	Australia, Radio	11880pa			
0700-0800 vl	Australia, VL8K Katherine	5025do				0800-0900	Australia, Radio	5995pa	9580pa	9710pa	12080as
0700-0800 vl	Australia, VL8T Tent Crk	4910do						15415as	15510pa	17750as	
0700-0800	Canada, CFRX Toronto	6070do				0800-0830 vl	Australia, VL8K Katherine	5025do			
0700-0800	Canada, CFVP Calgary	6030do				0800-0830 vl	Australia, VL8T Tent Crk	4910do			
0700-0800	Canada, CHNX Halifax	6130do				0800-0900 vl	Canada, CBC N Quebec Svc	9625do			
0700-0800	Canada, CKZU Vancouver	6160do				0800-0900	Canada, CFRX Toronto	6070do			
0700-0800	Costa Rica, RF Peace Intl	7385am	15050am			0800-0900	Canada, CFVP Calgary	6030do			
0700-0705	Croatia, Croatian Radio	6025eu	9830eu	13830au		0800-0900	Canada, CHNX Halifax	6130do			
0700-0727	Czech Rep, Radio Prague	7345as	9505eu			0800-0900	Canada, CKZU Vancouver	6160do			
0700-0800	Ecuador, HCJB	9640pa	11960eu	21455am		0800-0900	Costa Rica, RF Peace Intl	7385am	15050am		
0700-0800 as	Eqt Guinea, R East Africa	15186af				0800-0900	Ecuador, HCJB	9640pa	11960eu	21455am	
0700-0800 mtwhf	Eqt Guinea, Radio Africa	15186af				0800-0900 as	Eqt Guinea, R East Africa	15186af			
0700-0800	Germany, Overcomer Ministr	9500au				0800-0900 mtwhf	Eqt Guinea, Radio Africa	15186af			
0700-0715	Ghana, Ghana Broadc Corp	3366do	4915do			0800-0900	Germany, Overcomer Ministr	9500au			
0700-0800	Guyana, GBC/Voice of	3290do	5950do			0800-0805 s	Ghana, Ghana Broadc Corp	3366do			
0700-0800	Ireland, Unt Christian BC	6200do				0800-0900	Guam, TWR/KTWR	15200as			
0700-0800 as/vl	Italy, IRRS	7120va				0800-0900	Guyana, GBC/Voice of	3290do	5950do		
0700-0800 vl	Kiribati, Radio	9810do				0800-0900	Indonesia, Voice of	9525as	11785as		
0700-0800	Liberia, Radio Veritas	5470do				0800-0900	Ireland, Unt Christian BC	6200do			
0700-0800	Liberia, Star Radio	3400do				0800-0900 as/vl	Italy, IRRS	7120va			
0700-0715	Liberia, LCN/R Liberia Int	5100do				0800-0900 vl	Kiribati, Radio	9810do			
0700-0800	Malaysia, Radio	7295do				0800-0900	Liberia, Radio Veritas	5470do			
0700-0800	Malaysia, Voice of	6175as	9750as	15295au		0800-0900	Liberia, LCN/R Liberia Int	5100do			
0700-0730 smtwha	Malta, VO Mediterranean	9660eu				0800-0900	Malaysia, Radio	7295do			
0700-0800	Monaco, Trans World Radio	9755eu				0800-0900	Malaysia, Voice of	6175as	9750as	15295au	
0700-0710 mtwhf	New Zealand, R NZ Intl	11690pa				0800-0830	Malta, VO Mediterranean	9660eu			
0700-0800 as	New Zealand, R NZ Intl	6100pa				0800-0900 s	Monaco, Trans World Radio	9755eu			
0700-0730 s	Norway, Radio Norway Intl	13800eu	15640eu			0800-0835 a	Monaco, Trans World Radio	9755eu			
0700-0800 vl	Papua New Guinea, NBC	9675do				0800-0820 as	Netherlands, Radio	9720pa	9820pa		
0700-0800	Romania, R Romania Intl	17735af	21480af			0800-0900	New Zealand, R NZ Intl	6100pa			
0700-0800	Russia, Voice of Russia WS	9450au	17495au	17665au	21760au	0800-0900 as	Palau, KHBV/Voice of Hope	9985as			
		21790au				0800-0900 vl	Papua New Guinea, NBC	9675do			
0700-0710	Sierra Leone, SLBS	3316do				0800-0900	Russia, Voice of Russia WS	9450au	17495au	17665au	21760au
0700-0800	Singapore, R Corp Singapore	6150do						21790au			
0700-0730	Slovakia, R Slovakia Intl	9440au	15460au	17550au		0800-0810	Sierra Leone, SLBS	3316do			
0700-0800 vl	Solomon Islands, SIBC	5020do				0800-0900	Singapore, R Corp Singapore	6150do			
0700-0735	Swaziland, Trans World R	4775af	6100af	9500af		0800-0900 vl	Solomon Islands, SIBC	5020do			
0700-0800	Taiwan, Radio Taipei Intl	5950na				0800-0900	South Korea, R Korea Intl	9570au	13670eu		
0700-0800	UK, BBC African Service	6005af	6190af	9600af	11835af	0800-0805 as	Swaziland, Trans World R	4775af	6100af	9500af	
	UK, BBC Asian Service	11940af	17830af			0800-0900	UK, BBC African Service	6190af	11940af	15400af	17830af
0700-0800 as	UK, BBC African Service	17885af				0800-0900 as	UK, BBC African Service	17885af			
0700-0800	UK, BBC Asian Service	7145pa	9740as	11955pa	15310as	0800-0900	UK, BBC Asian Service	7145pa	9740as	11955pa	15310as
		15360as	17760as	17790as	21660as			15360as	17760as	17790as	21660as
0700-0800	UK, BBC World Service	5975am	6175am	6195eu	7325eu			7325eu	9410eu	12095eu	15485eu
		9410eu	11760me	12095eu	15485eu						
		15565eu	15575eu	17640me							
0700-0800	USA, KAIJ Dallas TX	5810am				0800-0900	UK, BBC World Service	7325eu	9410eu	12095eu	15485eu
0700-0800	USA, KTBN Salt Lk City UT	7510am						15565eu	17640eu		
0700-0800	USA, KWHR Naalehu HI	17555pa	17780as			0800-0900 as	UK, BBC World Service	15575as			
0700-0800	USA, WEWN Birmingham AL	5825eu	7405na			0800-0900	USA, KAIJ Dallas TX	5810am	9815am		
0700-0800	USA, WHRA Greenbush ME	11565af				0800-0859 s	USA, KHBI N Mariana Is	15665eu			
0700-0800	USA, WHRI Noblesville IN	5745am	7315am			0800-0900	USA, KNLS Anchor Point AK	9615as			
0700-0800	USA, WJCR Upton KY	7490na	13595na			0800-0900	USA, KTBN Salt Lk City UT	7510am			
0700-0800	USA, WMLK Bethel PA	9465am				0800-0900	USA, KWHR Naalehu HI	11565pa	17780as		
0700-0800	USA, WRMI/R Miami Intl	9955am				0800-0900	USA, WEWN Birmingham AL	5825eu	7405na		
0700-0800	USA, WRNO New Orleans LA	7395am				0800-0900	USA, WHRI Noblesville IN	5745am	7315am		
0700-0800	USA, WSHB Cypress Crk SC	7535eu	9835af			0800-0900	USA, WJCR Upton KY	7490na	13595na		
0700-0800	USA, WWCR Nashville TN	2390am	3210am	5070am	5935am	0800-0900	USA, WRMI/R Miami Intl	9955am			
0700-0800	USA, WYFR Okeechobee FL	7355eu	9985af	13695va		0800-0900	USA, WRNO New Orleans LA	7395am			
0700-0715 vl	Vanuatu, Radio	3945do	4960do			0800-0900	USA, WSHB Cypress Crk SC	7535eu	9835af	9845pa	
0700-0800	Zambia, Christian Voice	6065af				0800-0900	USA, WWCR Nashville TN	2390am	3210am	5070am	5935am
0700-0800 vl	Zambia, R Zambia/ZNBC 1	7220do				0800-0900	Vanuatu, Radio	3945do			
0700-0800 vl	Zambia, R Zambia/ZNBC 2	6165do				0800-0900	Zambia, Christian Voice	6065af			
0700-0800 vl	Zimbabwe, Zimbabwe BC	5975do				0800-0900 vl	Zambia, R Zambia/ZNBC 1	7220do			
0711-0800 mtwhf	New Zealand, R NZ Intl	6100pa				0800-0900 vl	Zambia, R Zambia/ZNBC 2	6165do			
0715-0730 s	Greece, Voice of	9375eu	9425au	9755au	11645eu	0800-0900 vl	Zimbabwe, Zimbabwe BC	5975do			
		15630au				0805-0810	Pakistan, Radio	15530eu	17555eu	17835eu	
0730-0800	Austria, R Austria Intl	6155eu	13730eu	15410me	17870me	0815-0900 mtwhf	Nigeria, FRNC/Radio	3326do	4770do	4990do	
0730-0755	Belgium, R Vlaanderen Int	7290eu	9940au			0815-0900 f	Seychelles, FEBA Radio	15540as			
0730-0740 s	Greece, Voice of	9375eu	9425eu	9755au	11645eu	0820-0835 as	Albania, TWR Tirana	9685eu			
		15630au				0830-0900	Australia, Radio	6080as			
0730-0800 s	Malta, VO Mediterranean	9660eu				0830-0900 vl	Australia, VL8A Alice Spg	2310do			
0730-0800	Netherlands, Radio	9730pa	9820pa			0830-0900 vl	Australia, VL8K Katherine	2485do			
0730-0800	Switzerland, Swiss R Intl	9885af	11860af	13635af		0830-0900 vl	Australia, VL8T Tent Crk	2325do			
0730-0800	UK, BBC African Service	6190af	9600af	11940af	15400af	0830-0900	Georgia, Radio	11910eu			
		17830af				0830-0900	Switzerland, Swiss R Intl	9885au	13685au		
0730-0800 as	UK, BBC World Service	15575eu				0835-0850 s	Albania, TWR Tirana	9685eu			
0735-0800 as	Swaziland, Trans World R	4775af	6100af	9500af		0835-0850 s	Monaco, Trans World Radio	9755eu			
0740-0800	Guam, TWR/KTWR	15200as				0855-0900	Guam, TWR/KTWR	15330pa			
0745-0800 s	Ghana, Ghana Broadc Corp	3366do	4915do								

## FREQUENCIES

0900-1000	Anguilla, Caribbean Beacon	6090am				1000-1100	Anguilla, Caribbean Beacon	6090am			
0900-1000	Australia, Radio	6080as	9580pa	11880pa	17750as	1000-1100	Australia, Radio	6080as	9580pa	11880pa	17750as
0900-1000 vl	Australia, VL8A Alice Spg	2310do				1000-1100 vl	Australia, VL8A Alice Spg	2310do			
0900-1000 vl	Australia, VL8K Katherine	2485do				1000-1100 vl	Australia, VL8K Katherine	2485do			
0900-1000 vl	Australia, VL8T Tent Crk	2325do				1000-1100 vl	Australia, VL8T Tent Crk	2325do			
0900-1000	Canada, CFRX Toronto	6070do				1000-1100 vl	Canada, CBC N Quebec Svc	9625do			
0900-1000	Canada, CFVP Calgary	6030do				1000-1100	Canada, CFRX Toronto	6070do			
0900-1000	Canada, CHNX Halifax	6130do				1000-1100	Canada, CFVP Calgary	6030do			
0900-1000	Canada, CKZU Vancouver	6160do				1000-1100	Canada, CHNX Halifax	6130do			
0900-1000	China, China Radio Intl	9785pa	11755pa			1000-1100	Canada, CKZU Vancouver	6160do			
0900-1000	Costa Rica, RF Peace Intl	7385am	15050am			1000-1100	China, China Radio Intl	9785pa	11755pa		
0900-0930	Czech Rep, Radio Prague	17485af	21745va			1000-1100	Costa Rica, RF Peace Intl	7385am	15050am		
0900-1000	Ecuador, HCJB	9640pa	21455am			1000-1100	Ecuador, HCJB	9640pa	21455am		
0900-1000 as	Eqt Guinea, R East Africa	15186af				1000-1100	Eqt Guinea, R East Africa	15186af			
0900-1000 mtwhf	Eqt Guinea, Radio Africa	15186af				1000-1100 as	Eqt Guinea, Radio Africa	15186af			
0900-0950	Germany, Deutsche Welle	6160pa	9565af	12055as	15205af	1000-1100 mtwhf	Germany, Overcomer Ministr	5900eu			
		15410af	17715as	17800af	21600af	1000-1100 as	Guam, AWR/KSDA	11790as			
		21680as				1000-1100	Guam, TWR/KTWR	9865as			
0900-1000	Germany, Overcomer Ministr	9500pa				1000-1100	India, All India Radio	11585au	11735au	13700au	15050au
0900-0915 mtwhf	Ghana, Ghana Broadc Corp	3366do	4915do					17387au	17840as		
0900-0915	Guam, TWR/KTWR	15200as				1000-1100	Ireland, Unt Christian BC	6200do			
0900-0930	Guyana, GBC/Voice of	3290do	5950do			1000-1100 as/vl	Italy, IRRS	7120va			
0900-1000	Ireland, Unt Christian BC	6200do				1000-1100	Japan, R Japan/NHK World	9695as	11730as	11850pa	
0900-1000 as/vl	Italy, IRRS	7120va				1000-1100	Jordan, Radio	11690eu			
0900-0930 vl	Kiribati, Radio	9810do				1000-1100	Liberia, Radio Veritas	5470do			
0900-1000	Liberia, Radio Veritas	5470do				1000-1100	Malaysia, Radio	7295do			
0900-0915	Liberia, LCN/R Liberia Int	5100do				1000-1100 irreg	Malaysia, RTM KotaKinabalu	5980do			
0900-1000	Malaysia, Radio	7295do				1000-1100 s	Malta, VO Mediterranean	9660eu			
0900-1000 vl	Malaysia, RTM Kuching	4895do	7160do			1000-1030	Netherlands, Radio	12065as	13710as		
0900-1000 s	Malta, VO Mediterranean	9660eu				1000-1100	New Zealand, R NZ Intl	6100pa			
0900-0925	Netherlands, Radio	9720pa	9820pa			1000-1100	Nigeria, Voice of	7255af	15120af		
0900-1000	New Zealand, R NZ Intl	6100pa				1000-1100 vl	Papua New Guinea, NBC	4890do			
0900-0930 s	Norway, Radio Norway Intl	15175au				1000-1100	Singapore, R Corp Singapore	6150do			
0900-1000 vl	Papua New Guinea, NBC	4890do				1000-1100 vl	Solomon Islands, SIBC	5020do			
0900-1000	Singapore, R Corp Singapore	6150do				1000-1030	Switzerland, Swiss R Intl	6165eu	9535eu		
0900-1000 vl	Solomon Islands, SIBC	5020do				1000-1100	UK, BBC African Service	6190af	11940af	17885af	
0900-1000	UK, BBC African Service	6190af	11940af	15400af	17830af	1000-1100 as	UK, BBC African Service	15400af	17830af		
		17885af				1000-1030	UK, BBC Asian Service	6195as	9740as	11765as	15310as
0900-0915	UK, BBC Asian Service	6065as	6195as	9580as	9740as			15360as	17790as	21660as	
		11765as	11955as	15310as	15360as	1000-1100	UK, BBC World Service	6195am	9410eu	11760me	12095eu
		17760as	17790as	21660as				15485eu	15565eu	15575eu	17640eu
0900-1000	UK, BBC World Service	9410eu	11760me	12095eu	15190sa	1000-1100 as	UK, BBC World Service	15190sa			
		15485eu	15565eu	15575eu	17640eu	1000-1100	USA, KAIJ Dallas TX	5810am	9815am		
		17705eu				1000-1059	USA, KHBI N Mariana Is	15665as	15725as		
0900-1000	USA, KAIJ Dallas TX	5810am	9815am			1000-1100	USA, KTBN Salt Lk City UT	7510am			
0900-0959	USA, KHBI N Mariana Is	13840pa	15665as			1000-1100	USA, KWHR Naalehu HI	9930as	11565pa		
0900-1000	USA, KTBN Salt Lk City UT	7510am				1000-1100	USA, WEWN Birmingham AL	5825eu	7405na	9590ca	
0900-1000	USA, KWHR Naalehu HI	11565pa	17780as					5985pa	6165ca		
0900-1000	USA, WEWN Birmingham AL	5825eu	7405na			1000-1100	USA, WHRI Noblesville IN	11720as	15425as		
0900-1000	USA, WHRI Noblesville IN	5745am	7315am					7425na	9465na	15745eu	
0900-1000	USA, WJCR Upton KY	7490na	13595na			1000-1100	USA, WGTG McCaysville GA	9400am			
0900-1000	USA, WRMI/R Miami Intl	9955am				1000-1100	USA, WHRI Noblesville IN	6040am	9495am		
0900-1000	USA, WRNO New Orleans LA	7355am				1000-1100	USA, WJCR Upton KY	7490na	13595na		
0900-1000	USA, WSHB Cypress Crk SC	7395sa	7535eu	9835af		1000-1100	USA, WRMI/R Miami Intl	9955am			
0900-1000	USA, WWCR Nashville TN	2390am	3210am	5070am	5935am	1000-1100	USA, WRNO New Orleans LA	7355am			
0900-1000	Zambia, Christian Voice	6065af				1000-1100	USA, WSHB Cypress Crk SC	6095na	7395sa		
0900-1000 vl	Zambia, R Zambia/ZNBC 1	7220do				1000-1100	USA, WWCR Nashville TN	2390am	5070am	5935am	
0900-1000 vl	Zambia, R Zambia/ZNBC 2	6165do				1000-1100 mtwhf	USA, WWCR Nashville TN	3210am			
0900-1000 vl	Zimbabwe, Zimbabwe BC	5975do				1000-1100 as	USA, WWCR Nashville TN	15685am			
0915-1000	Ghana, Ghana Broadc Corp	6130do	7295do			1000-1100 mtwhfa	USA, WYFR Okeechobee FL	5950na			
0915-0945	UK, BBC Asian Service	15310as	17790as			1000-1030	Vietnam, Voice of	9840as	12020as	15010as	
0915-0945 as	UK, BBC Asian Service	6195as	9740as	11765as	15360as	1000-1100	Zambia, Christian Voice	6065af			
		21660as				1000-1100 vl	Zambia, R Zambia/ZNBC 1	7220do			
0930-1000 mtwhfa	Austria, R Austria Intl	15455as	17870au			1000-1100 vl	Zambia, R Zambia/ZNBC 2	6165do			
0930-1000	Canada, CKZN St John's	6160do				1030-1100 s	Austria, R Austria Intl	15455as	17870au		
0930-1000	Georgia, Radio	11910eu				1030-1055	Belgium, R Vlaanderen Int	9925eu	15595eu		
0930-1000	Guam, TWR/KTWR	9865as				1030-1057	Czech Rep, Radio Prague	7345eu	11640eu		
0930-1000	Italy, AWR Europe	7230eu				1030-1100	Guam, AWR/KSDA	11790as	15170as		
0930-1000	Netherlands, Radio	12065as	13710as			1030-1035	Israel, Kol Israel	15640eu	15650na		
0945-1000	UK, BBC Asian Service	6195as	9740as	11765as	15360as	1030-1100	Netherlands, Radio	6045eu	9860eu	12065as	13710as
		17760as	17790as	21660as		1030-1100	South Korea, R Korea Intl	11715sa			
0945-1000 a	UK, BBC Asian Service	6065as	9580as	11945as	11955as	1030-1100	Sri Lanka, Sri Lanka BC	11835as	15120as	17850as	
		15280as				1030-1100	UK, BBC Asian Service	6195as	9740as	11765pa	15310as
0945-1000 smtwhf	UK, BBC Slow Speed News	6065as	9580as	11945as	11955as			17790as			
		15280as				1030-1045	Vatican State, Vatican R	5883eu	9645eu	11740eu	15595va



## Your Name in Lights!

... or at least in ink within the *Monitoring Times* Shortwave Guide. Please send us your "best catches" on the worldwide shortwave bands — QSLs, that is — and we will try to use them in future issues of *MT*. Your QSLs will be returned.

## FREQUENCIES

1100-1200	Anguilla, Caribbean Beacon	11775am				1100-1200	Taiwan, Radio Taipei Intl	7445as			
1100-1200	Australia, Radio	6080as	9580pa			1100-1200	UK, BBC African Service	6190af	11940af	15400af	17830af
1100-1200 vl	Australia, VL8A Alice Spg	2310do						17885af	21660af		
1100-1200 vl	Australia, VL8K Katherine	2485do				1100-1200	UK, BBC Asian Service	6195as	9580as	9740as	11955as
1100-1200 vl	Australia, VL8T Tent Crk	2325do						15280as	15310as	17785as	
1100-1200	Bulgaria, Radio	15175eu	17585eu			1100-1130 mtwhf	UK, BBC Caribbean Report	6195ca	15220ca		
1100-1200	Canada, CFRX Toronto	6070do				1100-1130	UK, BBC World Service	5965na	9410eu	11760me	12095eu
1100-1200	Canada, CFVP Calgary	6030do						15485eu	15565eu	15575eu	17640eu
1100-1200	Canada, CHNX Halifax	6130do						17705eu	17790sa		
1100-1200	Canada, CKZN St John's	6160do				1100-1130 as	UK, BBC World Service	6195am	15190sa	15220am	
1100-1200	Canada, CKZU Vancouver	6160do				1100-1200	USA, KAIJ Dallas TX	5810am	9815am		
1100-1200	Costa Rica, RF Peace Intl	7385am	15050am			1100-1159	USA, KHBI N Mariana Is	9385au	15665as		
1100-1200	Ecuador, HCJB	12005ca	15115am	21455am		1100-1200	USA, KTNB Salt Lk City UT	7510am			
1100-1200 as	Eqt Guinea, R East Africa	15186af				1100-1200	USA, KWHR Naalehu HI	9930as	11565pa		
1100-1200	Eqt Guinea, Radio Africa	9530as				1100-1200	USA, Voice of America	5985pa	6160as	9645as	9760as
1100-1150	Germany, Deutsche Welle	15370af	15410af	17765af	17800af			11720as	15160as	15425as	
1100-1200 as	Germany, Overcomer Ministr	5900eu				1100-1200	USA, WEWN Birmingham AL	7425na	9465na	15745eu	
1100-1200	Ireland, Unt Christian BC	6200do				1100-1200 occsnal	USA, WGTG McCaysville GA	9400am			
1100-1200 as/vl	Italy, IRRS	7120va				1100-1200	USA, WHRI Noblesville IN	6040am	9495am		
1100-1200	Japan, R Japan/NHK World	6120na	9695as	11730as		1100-1200	USA, WJCR Upton KY	7490na	13595na		
1100-1200	Jordan, Radio	11690eu				1100-1200	USA, WRMI/R Miami Intl	9955am			
1100-1110	Liberia, LCN/R Liberia Int	5100do				1100-1200	USA, WRNO New Orleans LA	7355am			
1100-1200	Malaysia, Radio	7295do				1100-1200	USA, WSHB Cypress Crk SC	6095na	7395sa		
1100-1200 irreg	Malaysia, RTM Kota Kinabalu	5980do				1100-1200	USA, WWCR Nashville TN	5070am	5935am	7435am	15685am
1100-1200 s	Malta, VO Mediterranean	9660eu				1100-1200 mtwhfa	USA, WYFR Okeechobee FL	5950na			
1100-1200	Myanmar, Voice of	5986do				1100-1200	USA, WYFR Okeechobee FL	5850na			
1100-1125	Netherlands, Radio	6045eu	9860eu	12065as	13710as	1100-1130	Vietnam, Voice of	7285as	9730as		
1100-1200	New Zealand, R NZ Intl	6100pa				1100-1200	Zambia, Christian Voice	6065af			
1100-1157	North Korea, R Pyongyang	3560as	9640af	9975me	11335va	1100-1200 vl	Zambia, R Zambia/ZNBC 1	7220do			
		15230va				1100-1200 vl	Zambia, R Zambia/ZNBC 2	6165do			
1100-1104	Pakistan, Radio	7110va	9645va	15530eu	17555eu	1104-1120	Pakistan, Radio	15530eu	17555eu	17835eu	
		17835eu				1125-1200	Netherlands, Radio	6045eu	9860eu		
1100-1130 as	Palau, KHBV/Voice of Hope	9965as				1130-1200 vl	China, China Radio Intl	6995as	8660as	11445as	11700as
1100-1200 vl	Papua New Guinea, NBC	4890do						15480as			
1100-1200	Singapore, R Singapore Int	6150as				1130-1200	Sweden, Radio	15240na	17870na		
1100-1130 vl	Solomon Islands, SIBC	5020do				1130-1200 as	UK, BBC Asian Service	15310as	17785as		
1100-1200	South Korea, R Korea Intl	7275as				1130-1200	UK, BBC World Service	6195am	15220am		
1100-1130	Sri Lanka, Sri Lanka BC	11835as	15120as	17850as		1130-1200	USA, Voice of America	11680eu			
1100-1200	Switzerland, Swiss R Intl	9810as	17515as			1130-1200 f	Vatican State, Vatican R	15595va	17550va		

## SELECTED PROGRAMS

## Sundays

- 1100 KWHR (Angel 3): The Water of Life Broadcast. See S 0100.  
 1100 KWHR (Angel 4): UPI News. See S 0000.  
 1100 WHRI (Angel 1&2): Breakthrough. See S 0500.  
 1105 KWHR (Angel 4): Music. See S 0005.

## Mondays

- 1100 KWHR (Angel 3&4): UPI News. See S 0000.  
 1100 WHRI (Angel 1): Ever Increasing Faith. Fredrick "K.C." Price evangelizes from Crenshaw Christian Center in Los Angeles.  
 1100 WHRI (Angel 2): UPI News. See S 0000.  
 1105 KWHR (Angel 3): Biblical Studies Institute. Bob Tref evangelizes from Rapid City, South Dakota.  
 1105 KWHR (Angel 4): Bible Pathway. See M 0400.  
 1105 WHRI (Angel 2): Music. See S 0005.  
 1110 KWHR (Angel 4): Music. See S 0005.  
 1115 WHRI (Angel 1): Sold Out for Jesus. Paul Tebbano evangelizes from Cockton Park, New York.  
 1130 KWHR (Angel 3): Faith Seminar of the Air. See M 0500.  
 1130 WHRI (Angel 1&2): The Hour of Courage. See M 0430.  
 1145 KWHR (Angel 3): Listen to Jesus. See M 0630.

## Tuesdays

- 1100 KWHR (Angel 3&4): UPI News. See S 0000.  
 1100 WHRI (Angel 1): Ever Increasing Faith. See M 1100.  
 1100 WHRI (Angel 2): UPI News. See S 0000.  
 1105 KWHR (Angel 3): Adventures in Odyssey. See S 0305.  
 1105 KWHR (Angel 4): Bible Pathway. See M 0400.  
 1105 WHRI (Angel 2): Music. See S 0005.  
 1110 KWHR (Angel 4): Music. See S 0005.  
 1115 WHRI (Angel 1): Sold Out for Jesus. See M 1115.  
 1130 KWHR (Angel 3): Faith Seminar of the Air. See M 0500.  
 1130 WHRI (Angel 1&2): The Hour of Courage. See M 0430.  
 1145 KWHR (Angel 3): Listen to Jesus. See M 0630.

## Wednesdays

- 1100 KWHR (Angel 3&4): UPI News. See S 0000.  
 1100 WHRI (Angel 1): Ever Increasing Faith. See M 1100.  
 1100 WHRI (Angel 2): UPI News. See S 0000.

- 1105 KWHR (Angel 3): Biblical Studies Institute. See M 1105.  
 1105 KWHR (Angel 4): Bible Pathway. See M 0400.  
 1105 WHRI (Angel 2): Music. See S 0005.  
 1110 KWHR (Angel 4): Music. See S 0005.  
 1115 WHRI (Angel 1): Sold Out for Jesus. See M 1115.  
 1130 KWHR (Angel 3): Faith Seminar of the Air. See M 0500.  
 1130 WHRI (Angel 1&2): The Hour of Courage. See M 0430.  
 1145 KWHR (Angel 3): Listen to Jesus. See M 0630.  
 1154 Radio Netherlands: Documentary. Philippines (Parts 1 and 2) (3rd/10th). People of this 7,000 island archipelago celebrate 100 years of independence from Spain this month.  
 1154 Radio Netherlands: Documentary. The High C's (Parts 1 and 2) (18th/25th). See A 0154.

## Thursdays

- 1100 KWHR (Angel 3&4): UPI News. See S 0000.  
 1100 WHRI (Angel 1): Ever Increasing Faith. See M 1100.  
 1100 WHRI (Angel 2): UPI News. See S 0000.  
 1105 KWHR (Angel 3): Adventures in Odyssey. See S 0305.  
 1105 KWHR (Angel 4): Bible Pathway. See M 0400.  
 1105 WHRI (Angel 2): Music. See S 0005.  
 1110 KWHR (Angel 4): Music. See S 0005.  
 1115 WHRI (Angel 1): Sold Out for Jesus. See M 1115.  
 1130 KWHR (Angel 3): Faith Seminar of the Air. See M 0500.  
 1130 WHRI (Angel 1&2): The Hour of Courage. See M 0430.  
 1145 KWHR (Angel 3): Listen to Jesus. See M 0630.

## Fridays

- 1100 KWHR (Angel 3&4): UPI News. See S 0000.  
 1100 WHRI (Angel 1): Ever Increasing Faith. See M 1100.  
 1100 WHRI (Angel 2): UPI News. See S 0000.  
 1105 KWHR (Angel 3): Biblical Studies Institute. See M 1105.  
 1105 KWHR (Angel 4): Bible Pathway. See M 0400.  
 1105 WHRI (Angel 2): Music. See S 0005.  
 1110 KWHR (Angel 4): Music. See S 0005.  
 1115 WHRI (Angel 1): Sold Out for Jesus. See M 1115.  
 1130 KWHR (Angel 3): Faith Seminar of the Air. See M 0500.  
 1130 WHRI (Angel 1&2): The Hour of Courage. See M 0430.  
 1145 KWHR (Angel 3): Listen to Jesus. See M 0630.

## Saturdays

- 1100 KWHR (Angel 3): Eternal Good News. Germaine Lockwood teaches from the Old Testament.  
 1100 WHRI (Angel 1&2): UPI News. See S 0000.  
 1105 WHRI (Angel 1): Music. See S 0005.  
 1106 KWHR (Angel 2): For the People (repeat). See M 0305.  
 1115 KWHR (Angel 3): The Scripture Hour. Evangelist Paul Fleming speaks from Greenville, SC.  
 1130 KWHR (Angel 3): Harvest Christian Center. Sharon Edwards.  
 1130 WHRI (Angel 1): The Voice of Power. See S 0630.

## HAUSER'S HIGHLIGHTS

## KOREA NORTH: RADIO PYONGYANG

New monitored schedule in English:

0000-0057	11845 13650 15230
0500-0557	3560? 11710 13790
1100-1157	3560 9640 9975 11335
	15230
1500-1557	3560 9640 9975 11735
	13650
1800-1857	4405 6575 9335 11700
	13760
1900-1957	6520 9600 9975
2100-2157	4405 6575 9335 11700
	13760
2300-2357	11335 11700 13760
	15130

(Sonny Ashimori, Japan, *Cumbre DX*)

## FREQUENCIES

1200-1300	Algeria, R Algiers Intl	11715me	15160me			1200-1300	UK, BBC Asian Service	6195as	9580as	9740as	11955as
1200-1300	Anguilla, Caribbean Beacon	11775am				1200-1300	UK, BBC World Service	5965na	6195am	9410eu	9515na
1200-1300	Australia, Radio	6020pa	6080as	9580pa	9770as	1200-1300		11760me	12095eu	15220am	15485eu
1200-1300 vl	Australia, VL8A Alice Spg	2310do				1200-1300	USA, KAIJ Dallas TX	5810am	9815am		
1200-1300 vl	Australia, VL8K Katherine	2485do				1200-1259	USA, KHBI N Mariana Is	9355as	9385pa		
1200-1300 vl	Australia, VL8T Tent Crk	2325do				1200-1300	USA, KTNB Salt Lk City UT	7510am			
1200-1300	Brazil, Radio Bras	15445na				1200-1300	USA, KWHR Naalehu HI	9930as	11565pa		
1200-1215 vl	Cambodia, Natl Voice of	11940do				1200-1300	USA, Voice of America	6160as	9645as	9760as	11715as
1200-1300 vl	Canada, CBC N Quebec Svc	9625do				1200-1300		15160as	15425as		
1200-1300	Canada, CFRX Toronto	6070do				1200-1300	USA, WEWN Birmingham AL	7425na	9465na	15745eu	
1200-1300	Canada, CFVP Calgary	6030do				1200-1300 occsnal	USA, WGTG McCaysville GA	9400am			
1200-1300	Canada, CHNX Halifax	6130do				1200-1300	USA, WHRI Noblesville IN	6040am	9495am		
1200-1300	Canada, CKZN St John's	6160do				1200-1300	USA, WJCR Upton KY	7490na	13595na		
1200-1300	Canada, CKZU Vancouver	6160do				1200-1300	USA, WRMV/R Miami Intl	9955am			
1200-1229	Canada, R Canada Intl	9640am	9660as	11855am	13650am	1200-1300	USA, WRNO New Orleans LA	7355am			
		15195as				1200-1300	USA, WSHB Cypress Crk SC	6095na	9455a		
1200-1300	China, China Radio Intl	6950pa	7385pa	9565as	9715as	1200-1300	USA, WWCR Nashville TN	5070am	7435am	13845am	15685am
1200-1230 vl	China, China Radio Intl	9945as	11660as	11675as	11980as	1200-1300 mtwhfa	USA, WYFR Okeechobee FL	5950na			
		6995as	8660as	11445as	11700as	1200-1300	USA, WYFR Okeechobee FL	5850na	6015na	17750na	
1200-1300	Costa Rica RF Peace Intl	7385am	15050am	21465am		1200-1230	Uzbekistan, R Tashkent	11905as	15295as	17775as	9715as
1200-1300	Ecuador, HCJB	12005ca	15115am	21455am		1200-1300 vl	Zambia, R Zambia/ZNBC 1	6065af			
1200-1300 as	Eq Guinea, R East Africa	15186af				1200-1300 vl	Zambia, R Zambia/ZNBC 2	7220do			
1200-1300	Eq Guinea, Radio Africa	9530as				1206-1300 occsnal	New Zealand, R NZ Intl	6165do			
1200-1300	France, Radio France Intl	11600as	13625ca	15155eu	15195eu	1209-1215 mtwhf	UK, BBC Caribbean Report	6100pa			
		15530ca	15540af	17575ca		1209-1215 as	UK, BBC World Service	6195ca	15220ca		
1200-1300	Ireland, Unt Christian BC	6200do				1215-1300	Egypt, Radio Cairo	6195as	15220am		
1200-1300 as/vl	Italy, IRRS	7120va				1229-1259	Canada, R Canada Intl	9640am	11855am	13650am	
1200-1300	Jordan, Radio	11690eu				1230-1300	Austria, R Austria Intl	6155eu	13730na		
1200-1300	Malaysia, Radio	7295do				1230-1300	Bangladesh, Bangla Betar	7185as	9550as		
1200-1300 irreg	Malaysia, RTM Kota Kinabalu	5980do				1230-1255	Belgium, R Vlaanderen Int	15545na			
1200-1230	Mongolia, Voice of	12085au				1230-1300 s	Finland, YLE/R Finland	11900na	15400na		
1200-1250	Myanmar, Voice of	5986do				1230-1300	Guam, AWR/KSDA	13720as			
1200-1225	Netherlands, Radio	6045eu	9860eu			1230-1300	Italy, AWR Europe	7230as			
1200-1206	New Zealand, R NZ Intl	6100pa				1230-1300	South Korea, R Korea Intl	6055as	9570as	9640am	13670as
1200-1230 s	Norway, Radio Norway Intl	17535as				1230-1300	Sri Lanka, Sri Lanka BC	9730as	15425as		
1200-1300	Palau, KHBN/Voice of Hope	9965as				1230-1300	Sweden, Radio	13740as	15240au		
1200-1300 vl	Papua New Guinea, NBC	4890do				1230-1300	Thailand, Radio	9655as	9885as	11905as	
1200-1255	Poland, Polish R Warsaw	6095eu	7145eu	7270eu	9525eu	1230-1300	Turkey, Voice of	15185as	15290eu	17830eu	
		11815eu				1230-1300 a	USA, Voice of America	7768eu			
1200-1300	Singapore, R Singapore Int	6150as				1230-1300	Vietnam, Voice of	9840as	12020as	15010as	
1200-1230	South Korea, R Korea Intl	7285as				1240-1250	Greece, Voice of	17525af			
1200-1230	Switzerland, Swiss R Intl	6165eu	9535eu			1240-1255 smtwh	UK, BBC Slow Speed News	7140me	11820me	13660af	15180af
1200-1300	Taiwan, Radio Taipei Intl	7130as	9610au					15555me	17585af		
1200-1300	UK, BBC African Service	6190af	11940af	17830af	17885af						
		21660af									

## SELECTED PROGRAMS

## Sundays

- 1200 Canada, RCI Montreal: World Report. CBC News.  
 1200 KWHR (Angel 4): UPI News. See S 0000.  
 1200 WHRI (Angel 1): Witness of Power. See S 0600.  
 1200 WHRI (Angel 2): In Touch. The Atlanta Bible-teaching ministry of Charles Stanley.  
 1205 KWHR (Angel 4): Music. See S 0005.  
 1208 Canada, RCI Montreal: Quirks and Quarks. Updating what's new and what's next in science.  
 1230 WHRI (Angel 1): DXing with Cumbre. See S 0330.

## Mondays

- 1200 Canada, RCI Montreal: CBC Radio News. See S 0200.  
 1200 KWHR (Angel 4): UPI News. See S 0000.  
 1200 WHRI (Angel 2): The Voice of Praise. See M 0645.  
 1205 KWHR (Angel 4): Music. See S 0005.  
 1207 Canada, RCI Montreal: The Inside Track. An award-winning program of sports journalism, examining the impact of sports on the lives of Canadians.  
 1215 WHRI (Angel 1): Midnight Cry. C. Parker Thomas evangelizes from Southern Pines, North Carolina.  
 1215 WHRI (Angel 2): Atlanta Bible College. Anthony Buzzard.  
 1230 WHRI (Angel 1&2): Faith Seminar of the Air. See M 0500.  
 1234 Canada, RCI Montreal: Madly Off in All Directions. See S 0206.  
 1245 WHRI (Angel 2): Life in the Word. Joyce Meyer offers help by example for everyday living.  
 1255 WHRI (Angel 1): Bible Pathway. See M 0400.

## Tuesdays

- 1200 Canada, RCI Montreal: CBC Radio News. See S 0200.  
 1200 KWHR (Angel 4): UPI News. See S 0000.  
 1200 WHRI (Angel 2): The Voice of Praise. See M 0645.  
 1205 KWHR (Angel 4): Music. See S 0005.  
 1211 Canada, RCI Montreal: As It Happens. Mary Lou Finlay and Barbara Budd host this daily phone-in show that introduces listeners to the newsmakers of the day and people whose stories might otherwise not be told.  
 1215 WHRI (Angel 1): Midnight Cry. See M 1215.  
 1215 WHRI (Angel 2): Atlanta Bible College. See M 1215.  
 1230 WHRI (Angel 1&2): Faith Seminar of the Air. See M 0500.  
 1245 WHRI (Angel 2): Life in the Word. See M 1245.  
 1255 WHRI (Angel 1): Bible Pathway. See M 0400.

## Wednesdays

- 1200 Canada, RCI Montreal: CBC Radio News. See S 0200.  
 1200 KWHR (Angel 4): UPI News. See S 0000.  
 1200 WHRI (Angel 2): The Voice of Praise. See M 0645.  
 1205 KWHR (Angel 4): Music. See S 0005.  
 1211 Canada, RCI Montreal: As It Happens. See T 1211.  
 1215 WHRI (Angel 1): Midnight Cry. See M 1215.  
 1215 WHRI (Angel 2): Atlanta Bible College. See M 1215.  
 1230 WHRI (Angel 1&2): Faith Seminar of the Air. See M 0500.  
 1245 WHRI (Angel 2): Life in the Word. See M 1245.  
 1255 WHRI (Angel 1): Bible Pathway. See M 0400.

## Thursdays

- 1200 Canada, RCI Montreal: CBC Radio News. See S 0200.

- 1200 KWHR (Angel 4): UPI News. See S 0000.  
 1200 WHRI (Angel 2): The Voice of Praise. See M 0645.  
 1205 KWHR (Angel 4): Music. See S 0005.  
 1211 Canada, RCI Montreal: As It Happens. See T 1211.  
 1215 WHRI (Angel 1): Midnight Cry. See M 1215.  
 1215 WHRI (Angel 2): Atlanta Bible College. See M 1215.  
 1230 WHRI (Angel 1&2): Faith Seminar of the Air. See M 0500.  
 1245 WHRI (Angel 2): Life in the Word. See M 1245.  
 1255 WHRI (Angel 1): Bible Pathway. See M 0400.

## Fridays

- 1200 Canada, RCI Montreal: CBC Radio News. See S 0200.  
 1200 KWHR (Angel 4): UPI News. See S 0000.  
 1200 WHRI (Angel 2): The Voice of Praise. See M 0645.  
 1205 KWHR (Angel 4): Music. See S 0005.  
 1211 Canada, RCI Montreal: As It Happens. See T 1211.  
 1215 WHRI (Angel 1): Midnight Cry. See M 1215.  
 1215 WHRI (Angel 2): Atlanta Bible College. See M 1215.  
 1230 WHRI (Angel 1&2): Faith Seminar of the Air. See M 0500.  
 1245 WHRI (Angel 2): Life in the Word. See M 1245.  
 1255 WHRI (Angel 1): Bible Pathway. See M 0400.

## Saturdays

- 1200 Canada, RCI Montreal: CBC Radio News. See S 0200.  
 1200 KWHR (Angel 4): The Call to Worship. See S 0600.  
 1200 WHRI (Angel 1&2): UPI News. See S 0000.  
 1205 KWHR (Angel 4): Music. See S 0005.  
 1205 WHRI (Angel 1): The Pat Boone Show. See S 0205.  
 1206 WHRI (Angel 2): For the People (repeat). See M 0305.  
 1211 Canada, RCI Montreal: As It Happens. See T 1211.

## FREQUENCIES

1300-1400	Anguilla,Caribbean Beacon	11775am			1300-1400	UK, BBC Asian Service	5990as	6195as	9740as	11750as
1300-1330	Australia, Radio	6020pa	6080as	9580pa	9770as		15310as			
1300-1400 vl	Australia, VL8A Alice Spg	2310do			1300-1400	UK, BBC World Service	5965na	6195am	9410eu	9515na
1300-1400 vl	Australia, VL8K Katherine	2485do					11760me	11865na	12095eu	15220am
1300-1400 vl	Australia, VL8T Tent Crk	2325do					15485eu	15565eu	15575eu	17640eu
1300-1320	Brazil, Radio Bras	15445na					17705eu			
1300-1400 vl	Canada, CBC N Quebec Svc	9625do			1300-1400	USA, KAIJ Dallas TX	5810am	9815am		
1300-1400	Canada, CFRX Toronto	6070do			1300-1359	USA, KHBI N Mariana Is	9355as	9385as		
1300-1400	Canada, CFVP Calgary	6030do			1300-1400	USA, KJES Mesquite NM	11715am			
1300-1400	Canada, CHNX Halifax	6130do			1300-1400	USA, KNLS Anchor Point AK	7365as			
1300-1400	Canada, CKZN St John's	6160do			1300-1400	USA, KTNB Salt Lk City UT	7510am			
1300-1400	Canada, CKZU Vancouver	6160do			1300-1400	USA, KWHR Naalehu HI	9930as	11565pa		
1300-1400 smtwhf	Canada, R Canada Intl	11855am	13650am		1300-1400	USA, Voice of America	6160as	9645as	9760as	11715as
1300-1400 mtwhf	Canada, R Canada Intl	9640am					15160as	15425as		
1300-1400	China, China Radio Intl	6140as	7385pa	9945as	11660as	1300-1400	USA, WEWN Birmingham AL	7425na	9465na	15745eu
		11675as	11980as			1300-1400 occsnal	USA, WGTG McCaysville GA	9400am		
1300-1400	Costa Rica,RF Peace Intl	7385am	15050am	21465am		1300-1400	USA, WHRI Noblesville IN	6040am	15105am	
1300-1330	Czech Rep, Radio Prague	13580as	21745af		1300-1400	USA, WJCR Upton KY	7490na	13595na		
1300-1400	Ecuador, HCJB	12005ca	15115am	21455am	1300-1400	USA, WRMI/R Miami Intl	9955am			
1300-1330	Egypt, Radio Cairo	17595as			1300-1400	USA, WRNO New Orleans LA	7355am			
1300-1400	Eqt Guinea, R East Africa	15186af			1300-1400	USA, WSHB Cypress Crk SC	9430na	9455na		
1300-1400	Eqt Guinea, Radio Africa	9530as			1300-1400	USA, WWCR Nashville TN	9475am	12160am	13845am	15685am
1300-1330 s	Germany, Universal Life	9710eu			1300-1400	USA, WYFR Okeechobee FL	11830na	11970na	13695na	17750na
1300-1400	Germany,Overcomer Ministr	11650eu	11855eu	11920eu	1300-1400	Zambia, Christian Voice	6065af			
1300-1400	Ireland, Unt Christian BC	6200do			1300-1400 vl	Zambia, R Zambia/ZNBC 1	7220do			
1300-1400 as/vl	Italy, IRRS	7120va			1300-1400 vl	Zambia, R Zambia/ZNBC 2	6165do			
1300-1400	Jordan, Radio	11690eu			1302-1400	USA, WYFR Okeechobee FL	11550as			
1300-1310	Liberia,LCN/R Liberia Int	5100do			1315-1400 mtwhfa	Bhutan, Bhutan BC Service	5030do			
1300-1400	Malaysia, Radio	7295do			1330-1359	Canada, R Canada Intl	9535as	11795as	11935eu	15325eu
1300-1400 irreg	Malaysia,RTM KotaKinabalu	5980do			1330-1359 mtwhfa	Canada, R Canada Intl	17820va			
1300-1400 occsnal	New Zealand, R NZ Intl	6100pa			1330-1400	China, Heilongjiang PBS	4840do			
1300-1330 s	Norway, Radio Norway Intl	9590eu	15640am	15650as	1330-1400	Guam, AWR/KSDA	9650as			
1300-1400	Palau, KHBV/Voice of Hope	9985as			1330-1400	India, All India Radio	9545as	11620as	13710as	
1300-1400 vl	Papua New Guinea, NBC	4890do			1330-1400	Netherlands, Radio	9890as	15585as		
1300-1400	Philippines, FEBC/R Intl	11995as			1330-1400	Sweden, Radio	13740as	15240na	17515au	
1300-1400	Romania, R Romania Intl	15250na	15390eu	17770eu	1330-1400	UAE, Radio Dubai	13630eu	13675eu	15395eu	21605eu
1300-1400	Russia,Voice of Russia WS	11655as	15510as	17570as	1330-1358	Uzbekistan, R Tashkent	5060as	5975as	7285as	9715as
1300-1400 as	S Africa, Channel Africa	9445af	17675af	17870af			11905as	15295as	17775as	
1300-1400	Singapore, R Singapore Int	6150as			1330-1400	Vietnam, Voice of	9840eu	12020as	15010as	
1300-1400	Sri Lanka, Sri Lanka BC	9730as	15425as		1335-1345	Greece, Voice of	9395eu	11730na	15175eu	15630eu
1300-1400	Switzerland, Swiss R Intl	7230as	7480as		1345-1400	Liberia, Radio Veritas	5470do			
1300-1330	Turkey, Voice of	15185as	15290eu	17830eu	1345-1400	Vatican State, Vatican R	13765au	15540au		
1300-1400	UK, BBC African Service	6190af	11940af	15420af						
		17885af	21660af							

## SELECTED PROGRAMS

## Sundays

- 1300 Canada, RCI Montreal: World Report. See S 1200.  
 1300 KWHR (Angel 3): Music. See S 0005.  
 1300 KWHR (Angel 4): DXing with Cumbre. See S 0330.  
 1300 WHRI (Angel 1): Gospel Crusade Ministries. See S 0630.  
 1300 WHRI (Angel 2): UPI News. See S 0000.  
 1305 WHRI (Angel 2): Music. See S 0005.  
 1311 Canada, RCI Montreal: This Morning (hour 1). David Enright and Avril Benoit co-host the Sunday Edition of this CBC magazine program (hour 1 of 3 hours).  
 1330 Canada, RCI Montreal: RCI News. See S 0100.  
 1330 KWHR (Angel 3): Christ Gospel Broadcast. BR Hicks of Jeffersonville, Indiana with a Bible lesson.  
 1330 KWHR (Angel 4): Adventures in Odyssey. See S 0305.  
 1330 WHRI (Angel 1): DXing with Cumbre. See S 0330.  
 1337 Canada, RCI Montreal: The Mailbag. Listener letters, musical selections, and happenings in Canada.

## Mondays

- 1300 Canada, RCI Montreal: CBC Radio News. See S 0200.  
 1300 KWHR (Angel 4): UPI News. See S 0000.  
 1300 WHRI (Angel 1): UPI News. See S 0000.  
 1305 Canada, RCI Montreal: This Morning Tonight. David Enright and Avril Benoit co-host the evening edition of this CBC magazine program.  
 1305 KWHR (Angel 3&4): Music. See S 0005.  
 1305 WHRI (Angel 2): Music. See S 0005.  
 1330 Canada, RCI Montreal: RCI News. See S 0100.  
 1330 WHRI (Angel 2): Lester Sumrall Teaching Series. See S 1400.  
 1341 Canada, RCI Montreal: Spectrum. A weekday magazine program of current affairs, features, and a business report.

## Tuesdays

- 1300 Canada, RCI Montreal: CBC Radio News. See S 0200.  
 1300 KWHR (Angel 4): UPI News. See S 0000.  
 1300 WHRI (Angel 1): UPI News. See S 0000.  
 1305 Canada, RCI Montreal: This Morning Tonight. See M 1305.  
 1305 KWHR (Angel 3&4): Music. See S 0005.  
 1305 WHRI (Angel 2): Music. See S 0005.  
 1330 Canada, RCI Montreal: RCI News. See S 0100.  
 1330 WHRI (Angel 2): Lester Sumrall Teaching Series. See S 1400.  
 1341 Canada, RCI Montreal: Spectrum. See M 1341.

## Wednesdays

- 1300 Canada, RCI Montreal: CBC Radio News. See S 0200.  
 1300 KWHR (Angel 4): UPI News. See S 0000.  
 1300 WHRI (Angel 1): UPI News. See S 0000.  
 1305 Canada, RCI Montreal: This Morning Tonight. See M 1305.  
 1305 KWHR (Angel 3&4): Music. See S 0005.  
 1305 WHRI (Angel 2): Music. See S 0005.  
 1330 Canada, RCI Montreal: RCI News. See S 0100.  
 1330 WHRI (Angel 2): Lester Sumrall Teaching Series. See S 1400.  
 1341 Canada, RCI Montreal: Spectrum. See M 1341.  
 1354 Radio Netherlands: Documentary. Philippines (Parts 1 and 2) (3rd/10th). See W 1154.  
 1354 Radio Netherlands: Documentary. The High C's (Parts 1 and 2) (18th/25th). See A 0154.

## Thursdays

- 1300 Canada, RCI Montreal: CBC Radio News. See S 0200.  
 1300 KWHR (Angel 4): UPI News. See S 0000.  
 1300 WHRI (Angel 1): UPI News. See S 0000.  
 1305 Canada, RCI Montreal: This Morning Tonight. See M 1305.

- 1305 KWHR (Angel 3&4): Music. See S 0005.  
 1305 WHRI (Angel 1&2): Music. See S 0005.  
 1330 Canada, RCI Montreal: RCI News. See S 0100.  
 1330 WHRI (Angel 2): Lester Sumrall Teaching Series. See S 1400.  
 1341 Canada, RCI Montreal: Spectrum. See M 1341.

## Fridays

- 1300 Canada, RCI Montreal: CBC Radio News. See S 0200.  
 1300 KWHR (Angel 4): UPI News. See S 0000.  
 1300 WHRI (Angel 1): UPI News. See S 0000.  
 1305 Canada, RCI Montreal: This Morning Tonight. See M 1305.  
 1305 KWHR (Angel 3&4): Music. See S 0005.  
 1305 WHRI (Angel 1&2): Music. See S 0005.  
 1330 Canada, RCI Montreal: RCI News. See S 0100.  
 1330 WHRI (Angel 2): Lester Sumrall Teaching Series. See S 1400.  
 1341 Canada, RCI Montreal: Spectrum. See M 1341.

## Saturdays

- 1300 KWHR (Angel 3): Music. See S 0005.  
 1300 KWHR (Angel 4): UPI News. See S 0000.  
 1300 WHRI (Angel 1): Listen to Jesus. See M 0630.  
 1300 WHRI (Angel 2): Biblical Studies Institute. See M 1105.  
 1305 KWHR (Angel 4): Music. See S 0005.  
 1330 Canada, RCI Montreal: RCI News. See S 0100.  
 1330 KWHR (Angel 3): Spirit of Truth. Don Young offers words of encouragement and joy.  
 1330 WHRI (Angel 1): Eternal Good News. See A 1100.  
 1335 Canada, RCI Montreal: Venture Canada. See S 0107.  
 1345 KWHR (Angel 3): Taste God's Goodness. See S 0630.  
 1345 WHRI (Angel 1): Music. See S 0005.

## FREQUENCIES

1400-1500	Anguilla, Caribbean Beacon	11775am				1400-1455 as	S Africa, Channel Africa	9445af	17675af	17870af	
1400-1500	Australia, Radio	5995pa	6020pa	6080as	9770as	1400-1500	Sri Lanka, Sri Lanka BC	9730as	15425as		
1400-1500 vl	Australia, VL8A Alice Spg	2310do				1400-1500	Switzerland, Swiss R Intl	9575as	15265as		
1400-1500 vl	Australia, VL8K Katherine	2485do				1400-1430	Thailand, Radio	9655as	9830as	11905as	
1400-1500 vl	Australia, VL8T Tent Crk	2325do				1400-1500	UK, BBC African Service	6190af	11940af	17830af	21470af
1400-1500 vl	Canada, CBC N Quebec Svc	9625do						21660af			
1400-1500	Canada, CFRX Toronto	6070do				1400-1500	UK, BBC Asian Service	5990as	6195as	9740as	11750as
1400-1500	Canada, CFVP Calgary	6030do						15310as			
1400-1500	Canada, CHNX Halifax	6130do				1400-1500	UK, BBC World Service	9410eu	9515na	11865na	12095eu
1400-1500	Canada, CKZN St John's	6160do						15220na	15485eu	15565eu	15575eu
1400-1500	Canada, CKZU Vancouver	6160do						17640eu	17705eu	17840am	
1400-1500 s	Canada, R Canada Intl	11855am	13650am			1400-1500	USA, KAIJ Dallas TX	13815am	15725sm		
1400-1500	China, China Radio Intl	7160as	7260as	7405na	9535as	1400-1459	USA, KHBI N Mariana Is	9355as			
		9700va	11825as			1400-1500	USA, KJES Mesquite NM	11715am			
1400-1500	Costa Rica, RF Peace Intl	7385am	15050am	21465am		1400-1500	USA, KTBN Salt Lk City UT	7510am			
1400-1500	Ecuador, HCJB	12005ca	15115am	21455am		1400-1500	USA, KWHR Naalehu HI	9930as	11565pa		
1400-1500 as	Eqt Guinea, R East Africa	15186af				1400-1500	USA, Voice of America	6160as	7125as	7215as	9645as
1400-1500	France, Radio France Intl	7110as	11910as	15405as	17560af			9760as	15160as	15255va	15395as
1400-1500	Germany, Overcomer Ministr	11855eu	11920eu	13810eu				15425as			
1400-1500	India, All India Radio	9545as	11620as	13710as		1400-1500	USA, WENW Birmingham AL	9455na	11875na	15375na	15745eu
1400-1500	Ireland, Unt Christian BC	6200do				1400-1500	USA, WGTG McCaysville GA	9400am			
1400-1430	Israel, Koi Israel	12535eu	15640na			1400-1500	USA, WHRI Noblesville IN	6040am	15105am		
1400-1500 as/vl	Italy, IRRS	7120va				1400-1500	USA, WJCR Upton KY	7490na	13595na		
1400-1500	Japan, R Japan/NHK World	9505na	11730as	11880af		1400-1500	USA, WRMI/R Miami Intl	9955am			
1400-1500	Jordan, Radio	11690eu				1400-1500	USA, WRNO New Orleans LA	7355am			
1400-1500	Liberia, Radio Veritas	5470do				1400-1500	USA, WWCR Nashville TN	9475am	12160am	13845am	15685am
1400-1500	Malaysia, Radio	7295do				1400-1500	USA, WYFR Okeechobee FL	11502as	11830na	11970na	17750na
1400-1500 vl	Malaysia, RTM Kuching	4895do	7160do			1400-1405	Vatican State, Vatican R	13765au	15540au		
1400-1500 irreg	Malaysia, RTM Kota Kinabalu	5980do				1400-1500	Zambia, Christian Voice	6065af			
1400-1430	Mexico, Radio Mexico Intl	9705na				1400-1500 vl	Zambia, R Zambia/ZNBC 1	7220do			
1400-1500	Netherlands, Radio	9890as	15585as			1400-1500 vl	Zambia, R Zambia/ZNBC 2	6165do			
1400-1500 occsnal	New Zealand, R NZ Intl	6100pa				1415-1425	Nepal, Radio	5005do	7165do		
1400-1500 as	Palau, KHBV/Voice of Hope	9985as				1430-1500	Australia, Radio	9500as	11660as		
1400-1500 vl	Papua New Guinea, NBC	4890do				1430-1500 vl	China, China Radio Intl	6995as	8660as	9880as	11445as
1400-1500	Philippines, FEBC/R Intl	11995as				1430-1500	Georgia, Voice of Hope	12120as			
1400-1500	Russia, Voice of Russia WS	4730as	4940as	4975as	7510as	1430-1500	Guam, AWR/KSDA	9385as			
		11655as	12025as	15510as	17570as	1440-1500	Myanmar, Voice of	5986do			

## SELECTED PROGRAMS

## Sundays

- 1400 Canada, RCI Montreal: CBC Radio News. See S 0200.  
 1400 Japan, NHK/Radio: News. See S 0000.  
 1400 KWHR (Angel 4): Lester Sumrall Teaching Series. The head of the Christian Center Church teaches.  
 1400 WHRI (Angel 1): UPI News. See S 0000.  
 1400 WHRI (Angel 2): Ayoka Radio. Moses Adio.  
 1405 WHRI (Angel 1): Music. See S 0005.  
 1406 Canada, RCI Montreal: This Morning (hour 2). David Enright and Avril Benoit co-host the Sunday Edition of this CBC magazine program (hour 2 of 3 hours).  
 1410 Japan, NHK/Radio: Asian Weekly. A magazine of news from other Asian broadcasters, entertainment update and music.  
 1430 KWHR (Angel 4): World Harvest Country Style. Joe Brashier plays country music with a Christian slant.

## Mondays

- 1400 Japan, NHK/Radio: News. See S 0000.  
 1400 KWHR (Angel 4): World Harvest (live). See M 1400.  
 1400 WHRI (Angel 1&2): World Harvest (live). An hour of Christian music and information for WHRI supporters.  
 1415 Japan, NHK/Radio: 44 Minutes. See M 0015.  
 1417 Japan, NHK/Radio: Guest Corner. See M 0017.  
 1434 Japan, NHK/Radio: Close Up. See M 0034.  
 1447 Japan, NHK/Radio: News Commentary. See M 0047.  
 1452 Japan, NHK/Radio: Tumbling Dice. See M 0052.

## Tuesdays

- 1400 Japan, NHK/Radio: News. See S 0000.  
 1400 KWHR (Angel 4): World Harvest (live). See M 1400.  
 1400 WHRI (Angel 1&2): World Harvest (live). See M 1400.  
 1415 Japan, NHK/Radio: 44 Minutes. See M 0015.  
 1417 Japan, NHK/Radio: Guest Corner. See M 0017.  
 1434 Japan, NHK/Radio: Close Up. See M 0034.  
 1447 Japan, NHK/Radio: News Commentary. See M 0047.  
 1452 Japan, NHK/Radio: Tumbling Dice. See M 0052.

## Wednesdays

- 1400 Japan, NHK/Radio: News. See S 0000.  
 1400 KWHR (Angel 4): World Harvest (live). See M 1400.  
 1400 WHRI (Angel 1&2): World Harvest (live). See M 1400.

- 1415 Japan, NHK/Radio: 44 Minutes. See M 0015.  
 1417 Japan, NHK/Radio: Guest Corner. See M 0017.  
 1434 Japan, NHK/Radio: Close Up. See M 0034.  
 1447 Japan, NHK/Radio: News Commentary. See M 0047.  
 1452 Japan, NHK/Radio: Tumbling Dice. See M 0052.

## Thursdays

- 1400 Japan, NHK/Radio: News. See S 0000.  
 1400 KWHR (Angel 4): World Harvest (live). See M 1400.  
 1400 WHRI (Angel 1&2): World Harvest (live). See M 1400.  
 1415 Japan, NHK/Radio: 44 Minutes. See M 0015.  
 1417 Japan, NHK/Radio: Guest Corner. See M 0017.  
 1434 Japan, NHK/Radio: Close Up. See M 0034.  
 1447 Japan, NHK/Radio: News Commentary. See M 0047.  
 1452 Japan, NHK/Radio: Tumbling Dice. See M 0052.

## Fridays

- 1400 Japan, NHK/Radio: News. See S 0000.  
 1400 KWHR (Angel 4): World Harvest (live). See M 1400.  
 1400 WHRI (Angel 1&2): World Harvest (live). See M 1400.  
 1415 Japan, NHK/Radio: 44 Minutes. See M 0015.  
 1417 Japan, NHK/Radio: Guest Corner. See M 0017.  
 1434 Japan, NHK/Radio: Close Up. See M 0034.  
 1447 Japan, NHK/Radio: News Commentary. See M 0047.  
 1452 Japan, NHK/Radio: Tumbling Dice. See M 0052.  
 1454 Japan, NHK/Radio: News Commentary. See M 0047.  
 1454 Radio Netherlands: Documentary. The High C's (Parts 1 and 2) (20th/27th). See W 1154.  
 1454 Radio Netherlands: Documentary. The High C's (Parts 1 and 2) (20th/27th). See A 0154.

## Saturdays

- 1400 Japan, NHK/Radio: News. See S 0000.  
 1400 KWHR (Angel 4): UPI News. See S 0000.  
 1400 WHRI (Angel 1): UPI News. See S 0000.  
 1405 KWHR (Angel 4): Adventures in Odyssey. See S 0305.  
 1405 WHRI (Angel 1): Home Schooling (live). See A 0100.  
 1405 WHRI (Angel 2): Music. See S 0005.  
 1410 Japan, NHK/Radio: Weekend Break. See S 0510.  
 1430 KWHR (Angel 4): Christian Country Music. See S 1430.  
 1430 WHRI (Angel 2): DXing with Cumbre. See S 0330.

HAUSER'S HIGHLIGHTS  
UKRAINE: RUI

Z98 frequencies registered during English broadcasts:

Program I to Europe, Russia, Kazakhstan:  
 0000-0100 5905 5915 6020 6080 7180 7240

0300-0400 5905 6020 6080 7410 13590

2100-2200 5905 6020 6080 7180 7240 7410 9560 13590

Program II:  
 0000-0100 NAm 9550 12040, SAm 9945  
 0300-0400 NAm 9550 12040  
 2100-2200 NAm 9550 12040, Au 7380 (BC-DX)



WHRI

## FREQUENCIES

1500-1600	Anguilla, Caribbean Beacon	11775am				1500-1530	S Africa, Channel Africa	9445af			
1500-1600	Australia, Radio	5995pa	6020pa	6080as	9500as	1500-1530 twfha	Seychelles, FEBA Radio	11600as			
		9770as	11660as			1500-1545 sm	Seychelles, FEBA Radio	11600as			
1500-1600 vl	Australia, VL8A Alice Spg	2310do				1500-1600	Singapore, RCorp Singapore	6150do			
1500-1600 vl	Australia, VL8K Katherine	2485do				1500-1600	Sri Lanka, Sri Lanka BC	15425as	15425as		
1500-1600 vl	Australia, VL8T Tent Crk	2325do				1500-1600	UK, BBC African Service	6190af	11860af	11940af	15400af
1500-1600 vl	Canada, CBC N Quebec Svc	9625do						15420af	17830af	21470af	21490af
1500-1600	Canada, CFRX Toronto	6070do						21660af			
1500-1600	Canada, CFVP Calgary	6030do				1500-1600	UK, BBC Asian Service	5975as	5990as	6195as	9740as
1500-1600	Canada, CHNX Halifax	6130do						11750as	15310as		
1500-1600	Canada, CKZN St John's	6160do				1500-1600	UK, BBC World Service	9410eu	9515na	11865na	12040eu
1500-1600	Canada, CKZU Vancouver	6160do						12095eu	15220na	15485eu	15575eu
1500-1559 s	Canada, R Canada Intl	11855am	13650am					17705eu	17840am		
1500-1600	China, China Radio Intl	7160as	7405na	9785as		1500-1600	USA, KAIJ Dallas TX	13815am	15725am		
1500-1600	Costa Rica, RF Peace Intl	7385am	15050am	21465am		1500-1600	USA, KJES Mesquite NM	11715am			
1500-1600	Ecuador, HCJB	12005ca	15115am	21455am		1500-1600	USA, KTNB Salt Lk City UT	15590am			
1500-1600 as	Egt Guinea, R East Africa	15186af				1500-1600	USA, KWHR Naalehu HI	7560pa	9930as		
1500-1600	Germany, Overcomer Ministr	13810me				1500-1600	USA, Voice of America	6110as	6160as	7125as	7215as
1500-1600	Guam, TWR/KTWR	15330as						9645as	9700me	9760as	15205va
1500-1600	Ireland, Unt Christian BC	6200do						15255va	15395as		
1500-1600 as/vl	Italy, IRRS	7120va				1500-1600	USA, WEWN Birmingham AL	9455na	11875na	15375na	15745eu
1500-1600	Japan, R Japan/NHK World	7200as	9505na	9750as	11730as	1500-1600	USA, WGTG McCaysville GA	9400am			
1500-1600	Jordan, Radio	11690eu				1500-1600	USA, WHRI Noblesville IN	13760am	15105am		
1500-1510	Liberia, LCN/R Liberia Int	5100do				1500-1600	USA, WJCR Upton KY	7490na	13595na		
1500-1600	Malaysia, Radio	7295do				1500-1600	USA, WRMI/R Miami Intl	9955am			
1500-1600 irreg	Malaysia, RTM Kota Kinabalu	5980do				1500-1600	USA, WRMI/R Miami Intl	9955am			
1500-1530	Mexico, Radio Mexico Intl	9705na				1500-1600	USA, WRNO New Orleans LA	15420am			
1500-1530	Mongolia, Voice of	9720as	12085as			1500-1600	USA, WWCN Nashville TN	9475am	12160am	13845am	15685am
1500-1515 s	Myanmar, Voice of	5986do				1500-1600	USA, WYFR Okeechobee FL	11830na	17750na		
1500-1525	Netherlands, Radio	9890as	15585as			1500-1502	USA, WYFR Okeechobee FL	11550as			
1500-1600 occsnal	New Zealand, R NZ Intl	6100pa				1500-1600	Zambia, Christian Voice	6065af			
1500-1600	Nigeria, Voice of	7255af	15120af			1500-1600 vl	Zambia, R Zambia/ZNBC 1	4910do			
1500-1557	North Korea, R Pyongyang	3560ca	9640af	9975me	11735sa	1500-1600 vl	Zambia, R Zambia/ZNBC 2	6165do			
		13650va				1530-1600	Guam, AWR/KSDA	9385as			
1500-1530 s	Norway, Radio Norway Intl	13800va				1535-1550	Vatican State, Vatican R	13765au	15500au		
1500-1530 as	Palau, KHBH/Voice of Hope	9985as				1545-1600	Albania, R Tirana Intl	11734eu	12084eu		
1500-1600 vl	Papua New Guinea, NBC	4890do				1545-1600 sh	Bangladesh, Bangla Betar	4880do			
1500-1600	Russia, Voice of Russia WS	4730me	4940me	4975me	7325me	1545-1600	Israel, Kol Israel	11605eu	15650na	17515na	
		9975me	11775me	15470me	17570me	1550-1600 a	Vatican State, Vatican R	13765va	15500va		
		17580me									

## SELECTED PROGRAMS

### Sundays

- 1500 Canada, RCI Montreal: News. News from either the Canadian Broadcasting Corporation (CBC) or Radio Canada International (RCI).
- 1500 KWHR (Angel 4): UPI News. See S 0000.
- 1500 WHRI (Angel 1): Walking in Power. Brother Pronk discusses Christian teaching from Florida.
- 1500 WHRI (Angel 2): Message to Israel. A program originating in Brooklyn, NY for Jewish listeners.
- 1505 Canada, RCI Montreal: This Morning (hour 3). David Enright and Avril Benoit co-host the Sunday Edition of this CBC magazine program (hour 3 of 3 hours).
- 1505 KWHR (Angel 3&4): Music. See S 0005.
- 1515 WHRI (Angel 2): The Bread of Life Broadcast. Ron Kresge preaches from the Church of God at Norwalk, Connecticut.
- 1530 WHRI (Angel 1): DXing with Cumbre. See S 0330.
- 1530 WHRI (Angel 2): Sandra Davis Ministries. Sandra Davis evangelizes from Massachusetts.
- 1545 WHRI (Angel 1): Music. See S 0005.

### Mondays

- 1500 KWHR (Angel 3&4): UPI News. See S 0000.
- 1500 WHRI (Angel 1&2): UPI News. See S 0000.
- 1505 KWHR (Angel 3&4): Music. See S 0005.
- 1505 WHRI (Angel 1&2): Bible Pathway. See M 0400.
- 1510 WHRI (Angel 1): The Inside Pitch. Marvin Lau with an inside look at sports and entertainment.
- 1510 WHRI (Angel 2): The Voice of Salvation. William Wilson of the Church of God of Prophecy presents music and inspiration.
- 1515 WHRI (Angel 1): Life in the Word. See M 1245.
- 1515 WHRI (Angel 2): Ever Increasing Faith. See M 1100.
- 1530 KWHR (Angel 3): Lester Sumrall Teaching Series. See S 1400.
- 1530 WHRI (Angel 1): Music. See S 0005.
- 1530 WHRI (Angel 2): The Voice of Power. See S 0630.
- 1545 WHRI (Angel 2): Faith Seminar of the Air. See M 0500.

### Tuesdays

- 1500 KWHR (Angel 3&4): UPI News. See S 0000.
- 1500 WHRI (Angel 1&2): UPI News. See S 0000.
- 1505 KWHR (Angel 3&4): Music. See S 0005.
- 1505 KWHR (Angel 4): Music. See S 0005.

- 1505 WHRI (Angel 1&2): Bible Pathway. See M 0400.
- 1510 WHRI (Angel 1): The Inside Pitch. See M 1510.
- 1510 WHRI (Angel 2): The Voice of Salvation. See M 1510.
- 1515 WHRI (Angel 1): Life in the Word. See M 1245.
- 1515 WHRI (Angel 2): Ever Increasing Faith. See M 1100.
- 1530 KWHR (Angel 3): Lester Sumrall Teaching Series. See S 1400.
- 1530 WHRI (Angel 1): Music. See S 0005.
- 1530 WHRI (Angel 2): The Voice of Power. See S 0630.
- 1545 WHRI (Angel 2): Faith Seminar of the Air. See M 0500.

### Wednesdays

- 1500 KWHR (Angel 3&4): UPI News. See S 0000.
- 1500 WHRI (Angel 1&2): UPI News. See S 0000.
- 1505 KWHR (Angel 3&4): Music. See S 0005.
- 1505 WHRI (Angel 1&2): Bible Pathway. See M 0400.
- 1510 WHRI (Angel 1): The Inside Pitch. See M 1510.
- 1510 WHRI (Angel 2): The Voice of Salvation. See M 1510.
- 1515 WHRI (Angel 1): Life in the Word. See M 1245.
- 1515 WHRI (Angel 2): Ever Increasing Faith. See M 1100.
- 1530 KWHR (Angel 3): Lester Sumrall Teaching Series. See S 1400.
- 1530 WHRI (Angel 1): Music. See S 0005.
- 1530 WHRI (Angel 2): The Voice of Power. See S 0630.
- 1545 WHRI (Angel 2): Faith Seminar of the Air. See M 0500.

### Thursdays

- 1500 KWHR (Angel 3&4): UPI News. See S 0000.
- 1500 WHRI (Angel 1&2): UPI News. See S 0000.
- 1505 KWHR (Angel 3&4): Music. See S 0005.
- 1505 WHRI (Angel 1&2): Bible Pathway. See M 0400.
- 1510 WHRI (Angel 1): The Inside Pitch. See M 1510.
- 1510 WHRI (Angel 2): The Voice of Salvation. See M 1510.
- 1515 WHRI (Angel 1): Life in the Word. See M 1245.
- 1515 WHRI (Angel 2): Ever Increasing Faith. See M 1100.
- 1530 KWHR (Angel 3): Lester Sumrall Teaching Series. See S 1400.
- 1530 WHRI (Angel 1): Music. See S 0005.
- 1530 WHRI (Angel 2): The Voice of Power. See S 0630.
- 1545 WHRI (Angel 2): Faith Seminar of the Air. See M 0500.

### Fridays

- 1500 KWHR (Angel 3&4): UPI News. See S 0000.

- 1500 WHRI (Angel 1&2): UPI News. See S 0000.
- 1505 KWHR (Angel 3&4): Music. See S 0005.
- 1505 WHRI (Angel 1&2): Bible Pathway. See M 0400.
- 1510 WHRI (Angel 1): The Inside Pitch. See M 1510.
- 1510 WHRI (Angel 2): The Voice of Salvation. See M 1510.
- 1515 WHRI (Angel 1): Life in the Word. See M 1245.
- 1515 WHRI (Angel 2): Ever Increasing Faith. See M 1100.
- 1530 KWHR (Angel 3): Lester Sumrall Teaching Series. See S 1400.
- 1530 WHRI (Angel 1): Music. See S 0005.
- 1530 WHRI (Angel 2): The Voice of Power. See S 0630.
- 1545 WHRI (Angel 2): Faith Seminar of the Air. See M 0500.

### Saturdays

- 1500 KWHR (Angel 3): Eternal Good News. See A 1100.
- 1500 KWHR (Angel 4): UPI News. See S 0000.
- 1500 WHRI (Angel 1): UPI News. See S 0000.
- 1500 WHRI (Angel 2): The Message of Love and Victory. Jan Graybill of Tulsa, Oklahoma with music and a Bible lesson.
- 1505 KWHR (Angel 4): The Pat Boone Show. See S 0205.
- 1505 WHRI (Angel 1): Music. See S 0005.
- 1530 KWHR (Angel 3): Rhema Radio Church. Kenneth Hagin, Jr. preaches from Tulsa, Oklahoma.
- 1533 WHRI (Angel 2): Adventures in Odyssey. See S 0305.

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## FREQUENCIES

1600-1700	Anguilla, Caribbean Beacon	11775am			1600-1606	UK, BBC Asian Service	3915as	5975as	5990as	6195as
1600-1700	Australia, Radio	5995pa	6020pa	6080as	9500as		7160as	9740as	11750as	15310as
		9770as	11660as			1600-1700	UK, BBC World Service	9410eu	9515na	12095eu
1600-1700 vl	Australia, VL8A Alice Spg	2310do						15575eu	17840am	
1600-1700 vl	Australia, VL8K Katherine	2485do				1600-1700	USA, KAIJ Dallas TX	13815am	15725am	
1600-1700 vl	Australia, VL8T Tent Crk	2325do				1600-1700	USA, KTEB Salt Lk City UT	15590am		
1600-1610	Bangladesh, Bangla Betar	4880do	15520do			1600-1700	USA, KWHR Naalehu HI	7560pa	9930as	
1600-1700 vl	Canada, CBC N Quebec Svc	9625do				1600-1700	USA, Voice of America	6035af	6110as	7125as
1600-1700	Canada, CFRX Toronto	6070do						9645as	9700me	9760as
1600-1700	Canada, CFVP Calgary	6030do						13710af	15205va	15225af
1600-1700	Canada, CHNX Halifax	6130do						15395as	15410af	15445af
1600-1700	Canada, CKZN St John's	6160do				1600-1700	USA, WEWN Birmingham AL	11875na	13615na	15375na
1600-1700	Canada, CKZU Vancouver	6160do				1600-1700	USA, WGTG McCaysville GA	9400am		
1600-1700	China, China Radio Intl	9565as	9620af			1600-1700	USA, WHRI Noblesville IN	13760am	15105am	
1600-1700 as	Costa Rica, Adv World R	9725na				1600-1700	USA, WJCR Upton KY	7490na	13595na	
1600-1700	Costa Rica, RF Peace Intl	7385am	15050am	21465am		1600-1700	USA, WMLK Bethel PA	9465am		
1600-1627	Czech Rep, Radio Prague	5930eu	17485af			1600-1700	USA, WRMI/R Miami Intl	9955am		
1600-1700	Ethiopia, Radio	7165af				1600-1700	USA, WRNO New Orleans LA	15420am		
1600-1700	France, Radio France Intl	11615af	11705af	12015af	15210af	1600-1700	USA, WSHB Cypress Crk SC	18930af		
		15530af				1600-1700	USA, WWCN Nashville TN	9475am	12160am	13845am
1600-1650	Germany, Deutsche Welle	6170as	7130af	7225as	9735af	1600-1700	USA, WYFR Okeechobee FL	11830na	15695va	17555va
		9875as	11810af	15145as	21695af			17750na	21525va	
1600-1700	Germany, Overcomer Minist	6130eu	13810me	15625va		1600-1610 a	Vatican State, Vatican R	13765va	15500va	
1600-1700	Guam, AWR/KSDA	9355as				1600-1630	Vietnam, Voice of	9840eu	12010eu	15010eu
1600-1630	GUAM, TWR/KTWR	15330as				1600-1700	Zambia, Christian Voice	3330af	4965af	
1600-1700	Ireland, Unt Christian BC	6200do				1600-1700 vl	Zambia, R Zambia/ZNBC 1	4910do		
1600-1700 as/vl	Italy, IRRS	3985va				1600-1700 vl	Zambia, R Zambia/ZNBC 2	6165do		
1600-1630	Jordan, Radio	11690eu				1606-1615	UK, BBC Asian Service	3915as	5975as	7160as
1600-1700	Lebanon, Voice of Hope	9960me						11750as		9740as
1600-1700	Malaysia, Radio	7295do				1606-1615 mtwhf	UK, BBC Asian Service	5990as	6195as	15310as
1600-1650 occsnal	New Zealand, R NZ Intl	6100pa				1610-1615	Bangladesh, Bangla Betar	4880do		
1600-1700	Nigeria, Voice of	7255af	15120af			1615-1645 as	UK, BBC African Service	11860af		
1600-1630 s	Norway, Radio Norway Intl	13800va	17640na	18950va		1615-1645	UK, BBC African Service	15420af		
1600-1630	Pakistan, Radio	7230va	9650me	11570me	15170af	1615-1700	UK, BBC Asian Service	3915as	5975as	7160as
		15495me	17720af					9740as	11750as	9510as
1600-1700 vl	Papua New Guinea, NBC	4890do				1615-1700 as	UK, BBC World Service	9515na		
1600-1700	Russia, Voice of Russia WS	11775me	11850me	15490me	15515me	1615-1630	Vatican State, Vatican R	4005eu	5883eu	7250eu
		17570me						11810eu		9645eu
1600-1625	S Africa, Channel Africa	6000af				1630-1700	Austria, R Austria Intl	6155eu	11855me	13710as
1600-1700	Singapore, R Corp Singapore	6150do				1630-1655	Belgium, R Vlaanderen Int	5910eu	7290eu	13730va
1600-1700	South Korea, R Korea Intl	5975am	9515af	9870af		1630-1657	Canada, R Canada Intl	6140as	7150as	
1600-1700 as	Sri Lanka, Sri Lanka BC	9730as	15425as			1630-1700	Egypt, Radio Cairo	15255af		
1600-1700	Swaziland, Trans World R	9500af				1630-1700	Slovakia, R Slovakia Intl	5920eu	6055eu	7345eu
1600-1615	Switzerland, Swiss R Intl	9575as	15265as			1645-1700	UK, BBC African Service	11860af	15420af	
1600-1645	UAE, Radio Dubai	13630eu	15395eu			1650-1700	Eqt Guinea, Radio Africa	15186af		
1600-1700	UK, BBC African Service	3255af	6190af	15400af	17830af	1650-1700 mtwhf	New Zealand, R NZ Intl	6145pa		
		21470af	21660af							

## SELECTED PROGRAMS

## Sundays

- 1600 KWHR (Angel 3&4): UPI News. See S 0000.  
 1600 WHRI (Angel 1): The Water of Life Broadcast. See S 0100.  
 1600 WHRI (Angel 2): The Treasure of Truth Broadcast. Joe Gray under the sponsorship of the United Churches of Christ.  
 1605 KWHR (Angel 3): Christian Country Music. See S 1430.  
 1605 KWHR (Angel 4): The Pat Boone Show. See S 0205.  
 1630 KWHR (Angel 3): DXing with Cumbre. See S 0330.  
 1630 WHRI (Angel 2): Witness of Power. See S 0600.

## Mondays

- 1600 KWHR (Angel 3&4): UPI News. See S 0000.  
 1600 WHRI (Angel 1): The Voice of Power. See S 0630.  
 1600 WHRI (Angel 2): Lester Sumrall Teaching Series. See S 1400.  
 1605 KWHR (Angel 3&4): Music. See S 0005.  
 1615 WHRI (Angel 1): The Radio Bible Hour. See M 0515.  
 1630 WHRI (Angel 1&2): Midnight Cry. See M 1215.  
 1645 WHRI (Angel 1): The Inside Pitch. See M 1510.  
 1645 WHRI (Angel 2): The Radio Bible Hour. See M 0515.  
 1655 WHRI (Angel 1): Bible Pathway. See M 0400.

## Tuesdays

- 1600 KWHR (Angel 3&4): UPI News. See S 0000.  
 1600 WHRI (Angel 1): The Voice of Power. See S 0630.  
 1600 WHRI (Angel 2): Lester Sumrall Teaching Series. See S 1400.  
 1605 KWHR (Angel 3&4): Music. See S 0005.  
 1615 WHRI (Angel 1): The Radio Bible Hour. See M 0515.  
 1630 WHRI (Angel 1&2): Midnight Cry. See M 1215.  
 1645 WHRI (Angel 1): The Inside Pitch. See M 1510.  
 1645 WHRI (Angel 2): The Radio Bible Hour. See M 0515.  
 1655 WHRI (Angel 1): Bible Pathway. See M 0400.

## Wednesdays

- 1600 KWHR (Angel 3&4): UPI News. See S 0000.  
 1600 WHRI (Angel 1): The Voice of Power. See S 0630.  
 1600 WHRI (Angel 2): Lester Sumrall Teaching Series. See S 1400.  
 1605 KWHR (Angel 3&4): Music. See S 0005.  
 1615 WHRI (Angel 1): The Radio Bible Hour. See M 0515.  
 1630 WHRI (Angel 1&2): Midnight Cry. See M 1215.  
 1645 WHRI (Angel 1): The Inside Pitch. See M 1510.  
 1645 WHRI (Angel 2): The Radio Bible Hour. See M 0515.  
 1655 WHRI (Angel 1): Bible Pathway. See M 0400.

## Thursdays

- 1600 KWHR (Angel 3&4): UPI News. See S 0000.  
 1600 WHRI (Angel 1): The Voice of Power. See S 0630.  
 1600 WHRI (Angel 2): Lester Sumrall Teaching Series. See S 1400.  
 1605 KWHR (Angel 3&4): Music. See S 0005.  
 1615 WHRI (Angel 1): The Radio Bible Hour. See M 0515.  
 1630 WHRI (Angel 1&2): Midnight Cry. See M 1215.  
 1645 WHRI (Angel 1): The Inside Pitch. See M 1510.  
 1645 WHRI (Angel 2): The Radio Bible Hour. See M 0515.  
 1655 WHRI (Angel 1): Bible Pathway. See M 0400.

## Fridays

- 1600 KWHR (Angel 3&4): UPI News. See S 0000.  
 1600 WHRI (Angel 1): The Voice of Power. See S 0630.  
 1600 WHRI (Angel 2): Lester Sumrall Teaching Series. See S 1400.  
 1605 KWHR (Angel 3&4): Music. See S 0005.  
 1615 WHRI (Angel 1): The Radio Bible Hour. See M 0515.  
 1630 WHRI (Angel 1&2): Midnight Cry. See M 1215.  
 1645 WHRI (Angel 1): The Inside Pitch. See M 1510.  
 1645 WHRI (Angel 2): The Radio Bible Hour. See M 0515.  
 1655 WHRI (Angel 1): Bible Pathway. See M 0400.

## Saturdays

- 1600 KWHR (Angel 3&4): UPI News. See S 0000.  
 1600 WHRI (Angel 1&2): UPI News. See S 0000.  
 1604 KWHR (Angel 3): Turn Your Radio On. See S 0300.  
 1605 KWHR (Angel 4): Music. See S 0005.  
 1605 WHRI (Angel 1): Music. See S 0005.  
 1605 WHRI (Angel 2): Lifetime Commentary. AD Sturm evangelizes from Minnesota.  
 1615 WHRI (Angel 2): Christ Gospel Broadcast. See S 1330.  
 1630 WHRI (Angel 2): Jesus to the World Mission. A plea for funds from Germany.  
 1635 WHRI (Angel 2): Jesus for Life Ministries. Anthony Lupardo.  
 1645 WHRI (Angel 2): The Scripture Hour. See A 1115.

HAUSER'S HIGHLIGHTS  
AUSTRIA: R AUSTRIA INT'L

Z-98 English to North America:  
 1230 on 13730  
 0030 and 0230 on 9655  
 0230 also to LAm on 9870,  
 13730  
 0530 via Canada 6015  
 (ORF)



1700-1800	Anguilla,Caribbean Beacon	11775am				1800-1900	Anguilla,Caribbean Beacon	11775am			
1700-1800	Australia, Radio	5995pa 9770as	6020pa 11880pa	6080as	9500as	1800-1900 mtwhf	Argentina, RAE	15345eu 5995pa	6080as	7240pa	9500as
1700-1800 vl	Australia, VL8A Alice Spg	2310do				1800-1900	Australia, Radio	9770as	11880pa		
1700-1800 vl	Australia, VL8K Katherine	2485do				1800-1900 vl	Australia, VL8A Alice Spg	2310do			
1700-1800 vl	Australia, VL8T Tent Crk	2325do				1800-1900 vl	Australia, VL8K Katherine	2485do			
1700-1800 vl	Canada, CBC N Quebec Svc	9625do				1800-1900 vl	Australia, VL8T Tent Crk	2325do			
1700-1800	Canada, CFRX Toronto	6070do				1800-1900	Bangladesh, Bangla Betar	7190eu	9570as	15520do	
1700-1800	Canada, CFVP Calgary	6030do				1800-1900	Brazil, Radio Bras	15265eu			
1700-1800	Canada, CHNX Halifax	6130do				1800-1900	Canada, CFRX Toronto	6070do			
1700-1800	Canada, CKZN St John's	6160do				1800-1900	Canada, CFVP Calgary	6030do			
1700-1800	Canada, CKZU Vancouver	6160do				1800-1900	Canada, CHNX Halifax	6130do			
1700-1800	China, China Radio Intl	5220af 9570af	7150af 9700af	7160af	7405af	1800-1900	Canada, CKZN St John's	6130do			
1700-1800	Costa Rica,RF Peace Intl	15050am	21465am			1800-1900	Canada, CKZU Vancouver	6160do			
1700-1727	Czech Rep. Radio Prague	5930eu	17485af			1800-1900	Costa Rica,RF Peace Intl	15050am	21465am		
1700-1800	Egypt, Radio Cairo	15255af				1800-1830	Egypt, Radio Cairo	15255af			
1700-1800	Eqt Guinea, Radio Africa	15186af				1800-1900	Eqt Guinea, Radio Africa	15186af			
1700-1730	France, Radio France Intl	11615af	15210af			1800-1900	Georgia, Voice of Hope	9310eu			
1700-1800	Georgia, Voice of Hope	9310eu				1800-1830 s	Germany, Universal Life	11605af			
1700-1800	Germany,Overcomer Ministr	6130eu	15625va			1800-1900	Germany,Overcomer Ministr	11820af	15625va		
1700-1800	Ireland, Unt Christian BC	6200do				1800-1815	Greece, Voice of	7450eu	9420eu	17705sa	17765na
1700-1800 vl	Italy, IRRS	3985va				1800-1900	India, All India Radio	7410eu	9650af	9950eu	11620eu
1700-1800	Japan, R Japan/NHK World	6090as 15355af	7110eu	9535na	9825as	1800-1900	Ireland, Unt Christian BC	11935af	13770af	15075af	
1700-1800	Lebanon, Voice of Hope	9960me				1800-1900 vl	Italy, IRRS	6200do			
1700-1800	Liberia, Star Radio	5880do				1800-1900	Kuwait, Radio	3985va			
1700-1800	Malaysia, Radio	7295do				1800-1900	Lebanon, Voice of Hope	11990na			
1700-1800 mtwhf	New Zealand, R NZ Intl	6145pa				1800-1900	Liberia, Star Radio	9960me			
1700-1715 vl	Palau, KHBN/Voice of Hope	9965as				1800-1815	Liberia, LCN/R Liberia Int	5880do			
1700-1800 vl	Papua New Guinea, NBC	4890do				1800-1900	Malaysia, Radio	5100do			
1700-1755	Poland, Polish R Warsaw	6000eu	6095eu	7285eu		1800-1900 s	Morocco, RTVM Marocaine	7295do			
1700-1800	Romania, R Romania Intl	9510eu	11940eu	15250eu		1800-1830	Netherlands, Radio	17815af			
1700-1800	Russia,Voice of Russia WS	9765eu 12070eu	9775eu 15350af	11655eu 17570af	11775af	1800-1830 mtwhf	Netherlands, Radio	6020af	7120af	11655af	
1700-1730	S Africa, Channel Africa	15240af				1800-1857	New Zealand, R NZ Intl	6145pa			
1700-1800	Singapore,RCorp Singapore	6150do				1800-1830 s	North Korea, R Pyongyang	4404eu	6575eu	9335eu	11700na
1700-1715 mtwh	Swaziland, Trans World R	3200af				1800-1900 vl	Norway, Radio Norway Intl	13760na			
1700-1800	Swaziland, Trans World R	9500af				1800-1900	Papua New Guinea, NBC	7485eu	15705am	15735va	18950af
1700-1800	UK, BBC African Service	3255af 11860af	6005af 15400af	6190af 17830af	9630af	1800-1900	Philippines, R Pilipinas	4890do			
1700-1745	UK, BBC Asian Service	3915as 9740as	5975as	7160as	9510as	1800-1900	Russia,Voice of Russia WS	11730me	11890me	15190me	
1700-1800	UK, BBC World Service	6095me 12095eu	6180eu 15485eu	6195eu 15575eu	9410eu 17840na	1800-1830	S Africa, AWR Africa	7290eu	7425af	9675eu	9765eu
1700-1800 w	UK, Merlin Network One	15200eu				1800-1830	S Africa, Channel Africa	9775eu	11655eu	11675eu	11775af
1700-1800	USA, KAIJ Dallas TX	13815am	15725am			1800-1900	Singapore,RCorp Singapore	12045af	12070eu	15350af	17570af
1700-1800	USA, KTVN Salt Lk City UT	15590am				1800-1900	Sudan, Radio Omdurman	3345af	3390af		
1700-1800	USA, KWHR Naalehu HI	7560pa	9930as			1800-1830	Swaziland, Trans World R	15240af			
1700-1800	USA, Voice of America	6110as 9645as	6160as 9700me	7125as 9760af	7215as 15135eu	1800-1900	UK, BBC African Service	6150do	9200af		
1700-1800 mtwhf	USA, Voice of America	15255va 17895af	15395as	15410af	15445af	1800-1830	UK, BBC Asian Service	7200af	9200af		
1700-1800	USA, WEWN Birmingham AL	5990as 9770as	6045as 11870as	7150as 12005as	9550as 12050as	1800-1830	USA, AWR Africa	3200af	9500af		
1700-1800	USA, WGTG McCaysville GA	15255as 9400am				1800-1900	USA, KJES Mesquite NM	3255af	6190af	11860af	15400af
1700-1800	USA, WHRI Noblesville IN	13760am	15105am			1800-1900 w	USA, KTVN Salt Lk City UT	17830af			
1700-1800	USA, WJCR Upton KY	7490na	13595na			1800-1900	USA, KWHR Naalehu HI	5975as	9510as	9740as	
1700-1800	USA, WMLK Bethel PA	9465am				1800-1859	USA, Voice of America	6095me	6180eu	6195eu	9410eu
1700-1800	USA, WRMI/R Miami Intl	9955am				1800-1900	USA, WEWN Birmingham AL	12095eu	15485eu	15575eu	17840na
1700-1800	USA, WRNO New Orleans LA	15420am				1800-1900	USA, WGTG McCaysville GA	15200eu			
1700-1800	USA, WWSB Cypress Crk SC	18930af				1800-1900	USA, WHRI Noblesville IN	13815am	15725am		
1700-1800	USA, WWCR Nashville TN	9475am	12160am	13845am	15685am	1800-1900	USA, WHRA Greenbush ME	9355eu	9385af		
1700-1800	USA, WYFR Okeechobee FL	15695eu	17555af			1800-1900	USA, WHRI Noblesville IN	15385am			
1700-1800	Zambia, Christian Voice	3330af	4965af			1800-1900	USA, WJCR Upton KY	15590am			
1700-1800 vl	Zambia, R Zambia/ZNBC 1	4910do				1800-1900	USA, WRMI/R Miami Intl	7560pa	13625as		
1700-1800 vl	Zambia, R Zambia/ZNBC 2	6165do				1800-1900	USA, WRNO New Orleans LA	6035af	7415af	9760af	11975af
1700-1800 vl	Zimbabwe, Zimbabwe BC	4828do				1800-1830	USA, WWSB Cypress Crk SC	15410af	15580af	17895af	
1715-1745 vl	Palau, KHBN/Voice of Hope	9965as				1800-1900	USA, WWCR Nashville TN	1510af	13615na	15375na	15745eu
1715-1800	Swaziland, Trans World R	3200af	9500af			1800-1900 vl	USA, WYFR Okeechobee FL	11875na			
1730-1755	Belgium, R Vlaanderen Int	11810me	17655af			1800-1900 vl	Zambia, R Zambia/ZNBC 1	11875na			
1730-1800	Guam, AWR/KSDA	9355as	13660me			1800-1900 vl	Zambia, R Zambia/ZNBC 2	9400am			
1730-1800	Netherlands, Radio	6020af	7120af	11655af		1800-1900	Zimbabwe, Zimbabwe BC	9495am	13760am		
1730-1800	Philippines, R Pilipinas	11730me	11890me	15190me		1800-1900	Zimbabwe, Zimbabwe BC	7490na	13595na		
1730-1800	S Africa, AWR Africa	12130af				1800-1900	Zimbabwe, Zimbabwe BC	7490na			
1730-1800 s	Sweden, Radio	13855va	15735va			1800-1900	Zimbabwe, Zimbabwe BC	9465am			
1730-1800 mtwhf	Sweden, Radio	6065va	15735va			1800-1900	Zimbabwe, Zimbabwe BC	9955am			
1730-1800 s	UK, BBC Asian Service	9750as	12045as	15565as		1800-1900	Zimbabwe, Zimbabwe BC	15420am			
1730-1800	Vatican State, Vatican R	13765af	15570af	17550af		1800-1900	Zimbabwe, Zimbabwe BC	15665eu	18930af		
1745-1800	Bangladesh, Bangla Betar	7190as	9570eu	15520do		1800-1900	Zimbabwe, Zimbabwe BC	9475am	12160am	13845am	15685am
1745-1800	India, All India Radio	7410eu 11935af	9650af 13780af	9950eu 15075af	11620eu	1800-1830	Zimbabwe, Zimbabwe BC	15695va			
1745-1800	Palau, KHBN/Voice of Hope	9965as				1800-1900	Zimbabwe, Zimbabwe BC	7440eu	9840eu	12020eu	15010eu
1745-1800	UK, BBC Asian Service	5975as	9510as	9740as		1800-1900	Zimbabwe, Zimbabwe BC	9780do			
						1800-1900	Zimbabwe, Zimbabwe BC	3330af	4965af		
						1800-1900 vl	Zimbabwe, Zimbabwe BC	4910do			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	6165do			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	4828do			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	9400am			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	9495am			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	7490na			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	9465am			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	9955am			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	15420am			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	15665eu			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	9475am			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	15695va			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	7440eu			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	9780do			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	3330af			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	4910do			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	6165do			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	4828do			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	9400am			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	9495am			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	7490na			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	9465am			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	9955am			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	15420am			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	15665eu			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	9475am			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	15695va			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	7440eu			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	9780do			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	3330af			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	4910do			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	6165do			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	4828do			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	9400am			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	9495am			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	7490na			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	9465am			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	9955am			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	15420am			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	15665eu			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	9475am			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	15695va			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	7440eu			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	9780do			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	3330af			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	4910do			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	6165do			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	4828do			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	9400am			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	9495am			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	7490na			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	9465am			
						1800-1900 vl	Zimbabwe, Zimbabwe BC	9955am			

## FREQUENCIES

1900-2000	Anguilla, Caribbean Beacon	11775am				2000-2100	Algeria, R Algiers Intl	11715af	15160af		
1900-2000	Australia, Radio	5995pa	6080as	7240pa	9500as	2000-2100	Anguilla, Caribbean Beacon	11775am			
		9770as	11880pa			2000-2100	Australia, Radio	5995pa	9500as	9770as	11880pa
1900-2000 vl	Australia, VL8A Alice Spg	2310do	VL8K-2485do		VL8T-2325do			12080as			
1900-1920	Brazil, Radio Bras	15265eu				2000-2100 vl	Australia, VL8A Alice Spg	2310do	VL8K-2485do	VL8T-2325do	
1900-2000	Bulgaria, Radio	9700eu	11720eu	CFRX-6070do		2000-2100	Canada, CFRX Toronto	6070do	CFVP-6030do	CHNX-6130do	
	CFVP-6030do CHNX-6130do	6955af	9440af	9600af	9870af	2000-2059	CKZN St John's-6160do	5995va	7235va	11690va	13650va
1900-2000	China, China Radio Intl	15050am	21465am				Canada, R Canada Intl	13670va	15325va	17820va	17870va
1900-2000	Costa Rica, RF Peace Intl	15115eu	21455am			2000-2100		5220af	6950eu	7160af	7170af
1900-2000	Ecuador, HCJB	15186af						9600va	9635af	9920eu	
1900-2000	Eqt Guinea, Radio Africa	6285eu				2000-2100	China, China Radio Intl	15050am	21465am		
1900-2000	Georgia, Voice of Hope	9640af	9670af	11785af	11810af	2000-2100	Costa Rica, RF Peace Intl	5930eu	11600as		
1900-1950	Germany, Deutsche Welle	13790af	15245af	15390af		2000-2100	Czech Rep, Radio Prague	15115eu	21455am		
		11820af	15625va			2000-2100	Ecuador, HCJB	15186af			
1900-2000	Germany, Overcomer Ministr	7465eu	9375eu			2000-2100	Eqt Guinea, Radio Africa	6285eu			
1900-1910	Greece, Voice of	5980am				2000-2030	Finland, YLE/R Finland	9615eu			
1900-2000	Guatemala, Adv World R	3975eu	7170eu			2000-2100	Georgia, Voice of Hope	9615eu			
1900-1930	Hungary, Radio Budapest	7410eu	9650af	9950eu	11620eu	2000-2050	Germany, Deutsche Welle	15625va			
1900-1945	India, All India Radio	11935af	13780af	15075af		2000-2100	Germany, Overcomer Ministr	3366do	4915do		
		6200do				2000-2030	Ghana, Ghana Broadc Corp	5980am			
1900-2000	Ireland, Unt Christian BC	9435eu	11605na	15640na	15650eu	2000-2100	Guatemala, Adv World R	9525as	15150as		
1900-1925	Israel, Kol Israel	3985va				2000-2100	Indonesia, Voice of	6200do			
1900-2000 vl	Italy, IRRS	4885do	4935do	6150do		2000-2100	Ireland, Unt Christian BC	3955va			
1900-2000 vl	Kenya, Kenya Broadc Corp	11990na				2000-2100 as/vl	Italy, IRRS	4885do	4935do	6150do	
1900-2000	Kuwait, Radio	5935eu				2000-2100 vl	Kenya, Kenya Broadc Corp	11990eu			
1900-1930 a	Latvia, Radio Latvia Intl	9960me				2000-2100	Kuwait, Radio	9960me			
1900-2000	Lebanon, Voice of Hope	3450do				2000-2100	Lebanon, Voice of Hope	3450do			
1900-2000	Liberia, Radio Veritas	5880do				2000-2100	Liberia, Radio Veritas	7295do	LCN-5100do		
1900-2000	Liberia, Star Radio	5100do				2000-2100	Malaysia, Radio	12060eu			
1900-1915	Liberia, LCN/R Liberia Int	7295do				2000-2100 smtwha	Malta, VO Mediterranean	9705na			
1900-2000	Malaysia, Radio	9705na				2000-2030	Mexico, Radio Mexico Intl	3270do			
1900-1930	Mexico, Radio Mexico Intl	3270do	3290do			2000-2100 vl	Namibia, NBC	6020af	3290do		
1900-2000 vl	Namibia, NBC	6020af	7120af	9895af	11655af	2000-2025	Netherlands, Radio	15315af	7120af	9895af	11655af
1900-2000	Netherlands, Radio	15315af	17605af					11735pa	17605af		
		9875pa				2000-2100	New Zealand, R NZ Intl	5019do			
1900-1957 smtwhf	New Zealand, R NZ Intl	7255af	15120af			2000-2015 vl	Niger, Voice du Sahel	3326do	4770do	4990do	
1900-2000	Nigeria, Voice of	6520af	9600af	9975me		2000-2005	Nigeria, FRCN/Radio	7255af	15120af		
1900-1957	North Korea, R Pyongyang	4890do				2000-2100	Nigeria, Voice of	15220au			
1900-2000 vl	Papua New Guinea, NBC	11730me	11890me	15190me		2000-2030 s	Norway, Radio Norway Intl	4890do			
1900-1930	Philippines, R Pilipinas	7290eu	7425af	9440af	9450eu	2000-2100 vl	Papua New Guinea, NBC	6035eu	6095eu	7285eu	9525eu
1900-2000	Russia, Voice of Russia WS	9820eu	11655eu	11675eu	11775af	2000-2025	Poland, Polish R Warsaw	7425af	9440af	9470af	9710eu
		11850af	12045af	15350af		2000-2100	Russia, Voice of Russia WS	9765eu	9775eu	9820eu	11675eu
		7230au						11850af	11930eu	12070eu	15485eu
1900-1930 smtwhf	Serbia, Radio Yugoslavia	6150do				2000-2005	S Africa, Voice of Hope	6290af			
1900-2000	Singapore, R Corp Singapore	5975as	7275as			2000-2015	Sierra Leone, SLBS	3316do			
1900-2000	South Korea, R Korea Intl	5975eu				2000-2100	Singapore, R Corp Singapore	6150do			
1900-2000 a	Sri Lanka, Sri Lanka BC	3200af				2000-2100 mtwhf	Spain, R Exterior Espana	9855eu	11830af		
1900-2000	Swaziland, Trans World R	6165eu	9885eu			2000-2015	Swaziland, Trans World R	3200af			
1900-1930	Switzerland, Swiss R Intl	7210eu	9655eu	11905eu		2000-2030	Switzerland, Swiss R Intl	9840af	9885af	9905af	11725af
1900-2000	Thailand, Radio	9445eu	11765na			2000-2015	Uganda, Radio	4976do			
1900-1920	Turkey, Voice of	3255af	6005af	6190af	9630af	2000-2100	UK, BBC (Af, Asia, World Svc.)	3255af	6005af	6190af	9630af
1900-2000	UK, BBC African Service	11835af	15400af	17830af			11835af	15400af	17830af	9740pa	6180eu
		5975as	9740pa				6195eu	7325eu			
1900-1930	UK, BBC Asian Service	6180eu	6195eu	9410eu	12095eu	2000-2100 w	UK, Merlin Network One	13690na	15590va		
1900-2000	UK, BBC World Service	15485eu				2000-2100	USA, KAIJ Dallas TX	13815am	15725am		
		13690na	15590va				KJES-15385am	KTBN-15590am			
1900-2000 w	UK, Merlin Network One	13815am	15725am			2000-2100	USA, KWHH Naalehu HI	15405as	17555pa		
1900-2000	USA, KAIJ Dallas TX	9355eu	9385af			2000-2100	USA, Voice of America	6035af	6095me	7375af	7415af
1900-1959	USA, KHBI N Mariana Is	15590am						9760af	9770af	11975af	15410af
1900-2000	USA, KTBN Salt Lk City UT	13625as	17555pa	7415af	9525pa			15445af	15580af	17725af	17755af
1900-2000	USA, KWHH Naalehu HI	6035af	7375af	7415af	9525pa	2000-2030	USA, Voice of America	4950af	11855af		
1900-2000	USA, Voice of America	9760af	11870pa	11975af	15180pa	2000-2100	USA, WEWN Birmingham AL	11875na	13615na	15375na	15745eu
		15410af	15445af	15580af		2000-2100	USA, WGTG McCaysville GA	9400am	WHRA-15460af		
		4950af				2000-2100	USA, WHRI Noblesville IN	9495am	13760am	WINB-13790am	
1900-2000 s	USA, Voice of America	4950af				2000-2100	USA, WJCR Upton KY	7490na	13595na		
1900-2000	USA, WEWN Birmingham AL	11875na	13615na	15375na	15745eu	2000-2100	USA, WMLK Bethel PA	9465am	WRMI-9955am	WRNO-15420am	
1900-2000	USA, WGTG McCaysville GA	9400am				2000-2100	USA, WWSH Cypress Crk SC	11550eu	13770eu	15665af	
1900-2000	USA, WHRA Greenbush ME	17655af				2000-2100	USA, WWCR Nashville TN	9475am	12160am	13845am	15685am
1900-2000	USA, WHRI Noblesville IN	9495am	13760am			2000-2100	USA, WYFR Okeechobee FL	11855na	15645va	17555va	17845va
1900-2000	USA, WJCR Upton KY	7490na	13595na			2000-2010	Vatican State, Vatican R	4005eu	5883eu	7250eu	9645eu
1900-2000	USA, WMLK Bethel PA	9465am				2000-2100	Zambia, Christian Voice	3330af	4965af	R Zambia-6165do	
1900-1930	USA, WRMI/R Miami Intl	9955am				2000-2100 vl	Zimbabwe, Zimbabwe BC	4828do			
1900-2000	USA, WRNO New Orleans LA	15420am				2005-2100	Syria, Radio Damascus	12085eu	13610na		
1900-2000	USA, WWSH Cypress Crk SC	15665eu	17510af			2010-2030	Vatican State, Vatican R	9660af	11625af	13765af	
1900-2000	USA, WWCR Nashville TN	9475am	12160am	13845am	15685am	2015-2045 mtwhfa	Armenia, Voice of	9965eu			
1900-1930	Vietnam, Voice of	9840eu	12020eu	15010eu		2025-2045	Italy, RAI Intl	7170af	9710af	11800af	
1900-2000	Zambia, Christian Voice	3330af	4965af			2030-2100 th	Belarus, R Belarus Intl	7210eu	11960eu		
1900-2000 vl	Zambia, R Zambia/ZNBC 1	4910do	ZNBC 2-6165do			2030-2100	Cuba, Radio Havana	13605eu	13715eu		
1900-2000 t	Zimbabwe, Zimbabwe BC	4828do				2030-2100	Egypt, Radio Cairo	15375af			
1930-2000	Belarus, R Belarus Intl	7210eu	11960eu			2030-2100	Germany, AWR Europe	9835af			
1930-2000	Georgia, Radio	6230eu				2030-2100 irreg	Iraq, Radio Iraq Intl	11785eu			
1930-2000	Iran, VOIRI	7260eu	9022eu			2030-2035 mtwhf	Latvia, Radio Latvia Intl	5935eu			
1930-2000	Mongolia, Voice of	9720eu	12085eu			2030-2055	Moldova, R Moldova Intl	7520eu			
1930-2000	Poland, Polish R Warsaw	6035eu	6095eu	7285eu	9525eu	2030-2100	S Africa, AWR Africa	9745af			
1930-2000 mtwhfa	Sweden, Radio	6065eu				2030-2100 as	Sweden, Radio	6065eu	13830eu		
1930-2000	Uganda, Radio	4976af				2030-2045	Thailand, Radio	9655eu	9680eu	11905eu	
1930-2000	UK, BBC Asian Service	9740pa				2030-2100	Turkey, Voice of	7210as			
1930-2000 mtwhfa	UK, BBC World Service	5975me				2030-2100 as	USA, Voice of America	4950af			
1935-1955	Italy, RAI Intl	5970eu	7145eu	9760eu		2030-2100	Uzbekistan, R Tashkent	7105eu	9540eu	9545eu	
1950-2000	Vatican State, Vatican R	4005eu	5883eu	7250eu	9645eu	2030-2100	Vietnam, Voice of	9840eu	12020eu	15010eu	
1951-2000 smtwh	New Zealand, R NZ Intl	11735pa				2045-2100 t	Germany, Universal Life	5890eu			
1956-2000	S Africa, Voice of Hope	6290af				2045-2100	India, All India Radio	7150au	7410eu	9910au	9950eu
1958-2000 as	New Zealand, R NZ Intl	11735pa						11620eu	11715au		

## FREQUENCIES

2100-2200	Anguilla, Caribbean Beacon	11775am			
2100-2200	Australia, Radio	9500as	9660pa	12080as	17795pa
2100-2130 vl	Australia, VL8A Alice Spg	2310do			
2100-2130 vl	Australia, VL8K Katherine	2485do			
2100-2200 vl	Australia, VL8K Katherine	5025do			
2100-2130 vl	Australia, VL8T Tent Crk	2325do			
2100-2200 vl	Australia, VL8T Tent Crk	4910do			
2100-2200	Bulgaria, Radio	9700eu	11720eu		
2100-2115 vl	Cameroon, Radio Cameroon	4850do			
2100-2200 vl	Canada, CBC N Quebec Svc	9625do			
2100-2200	Canada, CFRX Toronto	6070do			
2100-2200	Canada, CFVP Calgary	6030do			
2100-2200	Canada, CHNX Halifax	6130do			
2100-2200	Canada, CKZN St John's	6160do			
2100-2200	Canada, CKZU Vancouver	6160do			
2100-2129	Canada, R Canada Intl	7235va	11690va	11890va	13650va
		13670va	15150va	15325va	17820va
		17820va			
2100-2130	China, China Radio Intl	5220va	6950eu	7170af	7180af
		9535af	9670va	9920eu	
2100-2200	China, China Radio Intl	6950eu	9635eu	9920eu	
2100-2200	Costa Rica, RF Peace Intl	15050am	21465am		
2100-2130	Cuba, Radio Havana	13605eu	13715eu		
2100-2200	Ecuador, HCJB	15115eu	21455am		
2100-2200	Egypt, Radio Cairo	15375af			
2100-2200	Eqt Guinea, Radio Africa	15186af			
2100-2150	Germany, Deutsche Welle	7115as	9670as	9735af	9765as
		11785as	11865af	15135va	
2100-2115 t	Germany, Universal Life	5890eu			
2100-2130	Hungary, Radio Budapest	3975eu	11700eu		
2100-2200	India, All India Radio	7150au	7410eu	9910au	9950eu
		11620eu	11715au		
2100-2200 irreg	Iraq, Radio Iraq Intl	11785eu			
2100-2200	Ireland, Unt Christian BC	6200do			
2100-2200 as/vl	Italy, IRRS	3955va			
2100-2200	Japan, R Japan/NHK World	6035pa	9725eu	11850pa	13630na
2100-2110 vl	Kenya, Kenya Broadc Corp	4885do	4935do	6150do	
2100-2200	Liberia, Radio Veritas	3450do			
2100-2115	Liberia, LCN/R Liberia Int	5100do			
2100-2200	Malaysia, Radio	7295do			
2100-2200 smtwha	Malta, VO Mediterranean	12060eu			
2100-2200 vl	Namibia, NBC	3270do	3290do		
2100-2150	New Zealand, R NZ Intl	11735pa			
2100-2200	Nigeria, FRCN/Radio	3326do	4770do	4990do	
2100-2157	North Korea, R Pyongyang	4405eu	6575eu	9335eu	11700na
		13760na			
2100-2200 vl	Papua New Guinea, NBC	4890do			
2100-2200	Romania, R Romania Intl	6130eu	7195eu	9570eu	11830eu
2100-2130	Serbia, Radio Yugoslavia	6100eu	6185eu		
2100-2200	Singapore, R Corp Singapore	6150do			
2100-2130	South Korea, R Korea Intl	3970do	6480eu	15575eu	
2100-2200 s	Spain, R Exterior Espana	9855eu	11830af		
2100-2130	Switzerland, Swiss R Intl	3985eu			
2100-2200	Syria, Radio Damascus	12085na	13610na		
2100-2130	Turkey, Voice of	7210as			
2100-2110	Uganda, Radio	4976do			
2100-2200	UK, BBC African Service	3255af	6005af	6190af	11835af
2100-2200	UK, BBC Asian Service	3915as	5965as	5975pa	6195as
		9740pa	11945as		
2100-2200	UK, BBC World Service	5975am	6180eu	6195eu	7325eu
		9410eu	12095sa		
2100-2200 w	UK, Merlin Network One	11915eu	11985eu	13690va	
2100-2200	Ukraine, R Ukraine Intl	5905eu	6030eu	7240eu	7410eu
		9550na	9560eu	12040na	13590eu
2100-2200	USA, KAIJ Dallas TX	13815am	15725am		
2100-2200	USA, KTNB Salt Lk City UT	15590am			
2100-2200	USA, KWHR Naalehu HI	15405as	17555pa		
2100-2200	USA, Voice of America	6035af	6095me	7375af	7415af
		9535af	9760eu	11870pa	11975af
		15185as	15410af	15445af	15580af
		17725af	17735as		
2100-2200	USA, WEWN Birmingham AL	5825na	13615na	15375na	15745eu
2100-2200	USA, WGTG McCaysville GA	9400am			
2100-2200	USA, WHRA Greenbush ME	15460af			
2100-2200	USA, WHRI Noblesville IN	9495am	13760am		
2100-2200	USA, WINB Red Lion PA	13790am			
2100-2200	USA, WJCR Upton KY	7490na	13595na		
2100-2200	USA, WRMI/R Miami Intl	9955am			
2100-2200	USA, WRNO New Orleans LA	15420am			
2100-2200	USA, WSHB Cypress Crk SC	11550eu	13770eu	15665af	
2100-2200	USA, WWCR Nashville TN	9475am	12160am	13845am	15685am
2100-2200	USA, WYFR Okeechobee FL	11855na	15215va	15695va	17845va
2100-2200	Zambia, Christian Voice	3330af	4965af		
2100-2200 vl	Zambia, R Zambia/ZNBC 1	4910do			
2100-2200 vl	Zambia, R Zambia/ZNBC 2	6165do			
2100-2200 vl	Zimbabwe, Zimbabwe BC	4828do			
2105-2200 fa	New Zealand, R NZ Intl	17675pa			
2115-2200	Egypt, Radio Cairo	9900eu			
2115-2130 mtwhf	UK, BBC Caribbean Report	5975ca	15390ca	17715ca	
2115-2130 as	UK, BBC World Service	5975am			
2130-2200	Australia, Radio	13755pa			

2130-2200	Austria, R Austria Intl	5945eu	6155eu	13730va	9920eu
2130-2200	China, China Radio Intl	5220va	6950eu	9670va	
2130-2157	Czech Rep, Radio Prague	11600va			
2130-2200	Ghana, Ghana Broadc Corp	3366do			
2130-2200	Guam, AWR/KSDA	15310as			
2130-2155	Moldova, R Moldova Intl	7520eu			
2130-2200	South Korea, R Korea Intl	15575eu			
2130-2200 as	Sweden, Radio	6065eu	9430eu		
2130-2145 t f	UK, BBC Calling Falklands	11680sa			
2130-2200	USA, Voice of America	6040me	6095me	9535af	9760eu
		11870pa	15185as	17735as	
2130-2200 smtwhf	USA, Voice of America	6035af	7375af	7415af	11975af
		15410af	15445af	15580af	17725af
2130-2200	Uzbekistan, R Tashkent	7105eu	9540eu	9545eu	
2151-2200 smtwh	New Zealand, R NZ Intl	17675pa			

## 2200 UTC

2200-2300	Anguilla, Caribbean Beacon	11775am			
2200-2300	Australia, Radio	9660pa	12080as	13755pa	15510pa
		17795pa			
2200-2300 vl	Australia, VL8K Katherine	5025do			
2200-2300 vl	Australia, VL8T Tent Crk	4910do			
2200-2300	Canada, CBC N Quebec Svc	9625do			
2200-2300	Canada, CFRX Toronto	6070do			
2200-2300	Canada, CFVP Calgary	6030do			
2200-2300	Canada, CHNX Halifax	6130do			
2200-2300	Canada, CKZN St John's	6160do			
2200-2300	Canada, CKZU Vancouver	6160do			
2200-2229	Canada, R Canada Intl	5960am	9755am	11705as	13670am
		15305am			
2200-2300	China, China Radio Intl	7170eu			
2200-2230	China, China Radio Intl	3985eu			
2200-2300	Costa Rica, RF Peace Intl	7385am	15050am	21465am	
2200-2245	Egypt, Radio Cairo	9900eu			
2200-2300	Eqt Guinea, Radio Africa	15186af			
2200-2215	Ghana, Ghana Broadc Corp	4915do			
2200-2230	India, All India Radio	7150au	7410eu	9910au	9950eu
		11620eu	11715au		
2200-2300 irreg	Iraq, Radio Iraq Intl	11785eu			
2200-2300	Ireland, Unt Christian BC	6200do			
2200-2225	Italy, RAI Intl	6150pa	9675pa	11900as	
2200-2215	Liberia, LCN/R Liberia Int	5100do			
2200-2300	Malaysia, Radio	7295do			
2200-2300	New Zealand, R NZ Intl	17675pa			
2200-2215	Nigeria, FRCN/Radio	3326do	4770do	4990do	
2200-2230 s	Norway, Radio Norway Intl	13830au			
2200-2300 vl	Papua New Guinea, NBC	9675do			
2200-2215	Sierra Leone, SLBS	3316do			
2200-2300	Singapore, R Corp Singapore	6150do			
2200-2205	Syria, Radio Damascus	12085na	13610na		
2200-2300	Taiwan, Radio Taipei Intl	15600eu	17750eu		
2200-2300	Turkey, Voice of	7190eu	9655na		
2200-2300	UK, BBC African Service	11835af	15400af		
2200-2300	UK, BBC Asian Service	5965as	6195as	7110as	9660as
		9890as	11955as	12080ps	
2200-2300	UK, BBC World Service	5975am	6175na	6195na	7325eu
		9410eu	9590am	9915sa	12095sa
2200-2300 w	UK, Meriin Network One	9645eu	9780na	11915eu	11985na
		13690na			
2200-2300	USA, KAIJ Dallas TX	13815am	15725am		
2200-2300	USA, KTNB Salt Lk City UT	15590am			
2200-2300	USA, KWHR Naalehu HI	17510as	17555pa		
2200-2300	USA, Voice of America	7215as	9705as	9770as	11760as
		15185as	15290as	15305as	17735as
		17820as			
2200-2230 mtwhf	USA, Voice of America	6035af	7340af	7375af	7415af
		11975af			
2200-2300	USA, WEWN Birmingham AL	5825na	9975eu	13615na	15375na
2200-2300	USA, WGTG McCaysville GA	5085am			
2200-2300	USA, WHRA Greenbush ME	15460af			
2200-2300	USA, WHRI Noblesville IN	5745am	9495am		
2200-2300	USA, WINB Red Lion PA	13790am			
2200-2300	USA, WJCR Upton KY	7490na	13595na		
2200-2300	USA, WRMI/R Miami Intl	9955am			
2200-2300	USA, WRNO New Orleans LA	15420am			
2200-2300	USA, WSHB Cypress Crk SC	7510eu	13770sa		
2200-2300	USA, WWCR Nashville TN	5070am	7435am	9475am	13845am
2200-2300	USA, WYFR Okeechobee FL	11855na	15215va	17845va	
2200-2205 vl	Zambia, R Zambia/ZNBC 1	4910do			
2200-2210 vl	Zambia, R Zambia/ZNBC 2	6165do			
2230-2300	Canada, R Canada Intl	5960am	9755am	13670am	
2230-2300	Cuba, Radio Havana	6000am			
2230-2257	Czech Rep, Radio Prague	9435na	11600na		
2230-2300	UK, BBC World Service	5975am	6175na	9590na	9915sa
		12095sa			
2240-2250	Greece, Voice of	9420au	11645au		
2245-2300	Ghana, Ghana Broadc Corp	3366do	4915do		
2245-2300	India, All India Radio	7410as	9705as	9950as	11620as
2245-2300	Vatican State, Vatican R	7305au	9600au	11830au	

## FREQUENCIES

2300-0000	Anguilla, Caribbean Beacon	6090am				2300-0000	UK, BBC World Service	5975am	6175na	9590na	9915sa
2300-0000	Australia, Radio	9660pa	12080as	13755pa	15510pa	2300-0000 w	UK, Merlin Network One	12095sa			
2300-0000 vl	Australia, VL8K Katherine	5025do				2300-0000	USA, KAIJ Dallas TX	9645eu	9780na	11985na	13690na
2300-0000 vl	Australia, VL8T Tent Crk	4910do				2300-0000	USA, KATN Salt Lk City UT	13740am	13815am	15725am	
2300-0000	Bulgaria, Radio	9485na	11720na			2300-0000	USA, KWHR Naalehu HI	15590am			
2300-0000	Canada, CBC N Quebec Svc	9625do				2300-0000	USA, Voice of America	17510as	17555pa		
2300-0000	Canada, CFRX Toronto	6070do						7215as	9705as	9770as	11760as
2300-0000	Canada, CFVP Calgary	6030do						15185as	15290as	15305as	17735as
2300-0000	Canada, CHNX Halifax	6130do						17820as			
2300-0000	Canada, CKZN St John's	6160do				2300-0000	USA, WEWN Birmingham AL	5825na	9975eu	13615na	15375na
2300-0000	Canada, CKZU Vancouver	6160do				2300-0000	USA, WGTG McCaysville GA	5085am			
2300-2329	Canada, R Canada Intl	5960am	9755am	11895am	13670am	2300-0000	USA, WHRA Greenbush ME	15460af			
		15305am				2300-0000	USA, WHRI Noblesville IN	5745am	9495am		
2300-0000	Costa Rica, RF Peace Intl	7385am	15050am	21465am		2300-0000	USA, WINB Red Lion PA	13790am			
2300-2330	Cuba, Radio Havana	6000am				2300-0000	USA, WJCR Upton KY	7490na	13595na		
2300-0000	Egypt, Radio Cairo	9900na				2300-0000	USA, WRMI/R Miami Intl	9955am			
2300-2350	Germany, Deutsche Welle	5975as	6090as	7235as	9690as	2300-0000	USA, WRNO New Orleans LA	7355am			
2300-2330 as	Guam, AWR/KSDA	11775as				2300-0000	USA, WSHB Cypress Crk SC	7510eu	13770sa		
2300-0000 mtwhf	Guam, AWR/KSDA	11775as				2300-0000	USA, WWCR Nashville TN	5070am	7435am	9475am	13845am
2300-0000	India, All India Radio	7410as	9705as	9950as	11620as	2300-0000	USA, WYFR Okeechobee FL	11855na			
2300-0000	Ireland, Unt Christian BC	6200do				2300-2315	Vatican State, Vatican R	7305au	9600au	11830au	
2300-2315	Liberia, LCN/R Liberia Intl	5100do				2310-2315	Kyrgyzstan, Kyrgyz Radio	4010do	4050do		
2300-0000	Malaysia, Radio	7295do				2329-2359 as	Canada, R Canada Intl	11895am	15305am		
2300-0000	New Zealand, R NZ Intl	17675pa				2329-2359	Canada, R Canada Intl	5960am	9755am	13670am	
2300-2315	Nigeria, FRCN/Radio	3326do	4770do	4990do		2330-0000 vl	Ghana, Ghana Broadc Corp	4915af			
2300-2357	North Korea, R Pyongyang	11335na	11700na	13760na	15130na	2330-0000	Netherlands, Radio	6020na	6165na	9845na	
2300-2330 s	Norway, Radio Norway Intl	11640as	11735sa	13805am	13830as	2330-0000	Vietnam, Voice of	9840eu	12020eu	15010eu	
2300-0000 vl	Papua New Guinea, NBC	9675do				2335-2345	Greece, Voice of	9395sa	9425sa	9935sa	11595sa
2300-0000	Romania, R Romania Intl	9570na	11830na					11640sa			
2300-0000	Singapore, R Corp Singapore	6150do				2335-2345	Sierra Leone, SLBS	3316do			
2300-0000	UK, BBC Asian Service	3915as	5965as	6035as	6195as	2345-0000 mtwhf	UK, BBC Asian Service	3915as			
		7110as	11945as	11955as	17790as						

## SELECTED PROGRAMS

## Sundays

- 2300 Canada, RCI Montreal: CBC Radio News. See S 0200.  
 2300 KWHR (Angel 4): UPI News. See S 0000.  
 2300 WHRA (Angel 5): Turn Your Radio On. See S 0300.  
 2300 WHRI (Angel 2): Black Robe Brigade (live). John Lewis.  
 2305 Canada, RCI Montreal: Sound Advice. Rick Phillips presents the CBC weekly guide to the world of classical music and recordings (90 minutes).  
 2305 KWHR (Angel 4): The Pat Boone Show. See S 0205.

## Mondays

- 2300 Canada, RCI Montreal: The World at Six. CBC radio's major newscast of the day, presenting the important stories in depth and in context.  
 2300 KWHR (Angel 4): UPI News. See S 0000.  
 2300 WHRA (Angel 5): Music. See S 0005.  
 2300 WHRI (Angel 2): The Hour of Courage. See M 0430.  
 2305 KWHR (Angel 4): Music. See S 0005.  
 2330 KWHR (Angel 3): Lester Sumrall Teaching Series. See S 1400.  
 2330 WHRI (Angel 2): Radio Liberty. The story behind the story and the news behind the news.

## Tuesdays

- 2300 Canada, RCI Montreal: The World at Six. See M 2300.  
 2300 KWHR (Angel 4): UPI News. See S 0000.  
 2300 WHRA (Angel 5): Music. See S 0005.  
 2300 WHRI (Angel 2): The Hour of Courage. See M 0430.  
 2305 KWHR (Angel 4): Music. See S 0005.  
 2330 KWHR (Angel 3): Lester Sumrall Teaching Series. See S 1400.  
 2330 WHRI (Angel 2): Radio Liberty. See M 2330.

## Wednesdays

- 2300 Canada, RCI Montreal: The World at Six. See M 2300.  
 2300 KWHR (Angel 4): UPI News. See S 0000.  
 2300 WHRA (Angel 5): Music. See S 0005.  
 2300 WHRI (Angel 2): The Hour of Courage. See M 0430.  
 2305 KWHR (Angel 4): Music. See S 0005.  
 2330 KWHR (Angel 3): Lester Sumrall Teaching Series. See S 1400.  
 2330 WHRI (Angel 2): Radio Liberty. See M 2330.

## Thursdays

- 2300 Canada, RCI Montreal: The World at Six. See M 2300.  
 2300 KWHR (Angel 4): UPI News. See S 0000.  
 2300 WHRA (Angel 5): Music. See S 0005.  
 2300 WHRI (Angel 2): The Hour of Courage. See M 0430.  
 2305 KWHR (Angel 4): Music. See S 0005.

- 2330 KWHR (Angel 3): Lester Sumrall Teaching Series. See S 1400.  
 2330 WHRI (Angel 2): Radio Liberty. See M 2330.

## Fridays

- 2300 Canada, RCI Montreal: The World at Six. See M 2300.  
 2300 KWHR (Angel 4): UPI News. See S 0000.  
 2300 WHRA (Angel 5): Music. See S 0005.  
 2300 WHRI (Angel 2): The Hour of Courage. See M 0430.  
 2305 KWHR (Angel 4): Music. See S 0005.  
 2330 KWHR (Angel 3): Lester Sumrall Teaching Series. See S 1400.  
 2330 WHRI (Angel 2): Radio Liberty. See M 2330.  
 2354 Radio Netherlands: Documentary. Philippines (Parts 1 and 2) (5th/12th). See W 1154.

## Saturdays

- 2300 Canada, RCI Montreal: CBC Radio News. See S 0200.  
 2300 KWHR (Angel 4): UPI News. See S 0000.  
 2300 WHRA (Angel 5): Music. See S 0005.  
 2300 WHRI (Angel 2): The Prophecy Club. See M 0400.  
 2305 KWHR (Angel 4): Music. See S 0005.  
 2305 WHRI (Angel 1): Music. See S 0005.  
 2307 Canada, RCI Montreal: Quirks and Quarks. See S 1208.  
 2330 WHRI (Angel 2): The Bread of Life Broadcast. See S 1515.  
 2345 WHRI (Angel 2): Wind of the Spirit. Barbara Jennison.

HAUSER'S HIGHLIGHTS  
ROMANIA: R ROMANIA INT'L

## Z-98 schedule—

<u>Europe</u>	
0640-0700	11885, 9665, 9625, 9550
1300-1400	17770, 15390
1700-1800	15250, 11940, 9510
2100-2200	11830, 9570, 7195, 6130
<u>North America</u>	
2300-2400	11830, 9570
0200-0300	9570, 6155
0400-0500	11940, 9570
0600-0700	11940, 9510
1300-1400	17790, 15250
<u>Pacific/Japan</u>	
0200-0300	11740, 9690 (Japan), 11940, 15380
<u>Asia</u>	
0200-0300	11740, 9690
0400-0500	17720, 15335
<u>Africa</u>	
0700-0800	21480, 17735

(RRI, from not entirely legible fax)

For the morning 1300-1400 broadcast, we found 17790 best, 17770 weaker with co-channel, 15390 clear but weak, 15250 accompanied by noise probably from RRI's own transmitter, and missing the next day. The 2300 hour is again partly for NAM; and the 0600 should be more audible now on higher summer frequencies.

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- Activity log function automatically records and calculates total spectrum usage time.
- Unique search operation stores all frequencies found active and then automatically skips those frequencies during the remaining search cycles. This feature eliminates redundant logging.

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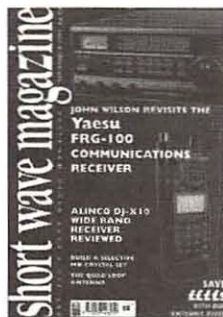


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## Cheap Electricity with LF

I can hear your question now: "What does propagation have to do with cheap electricity?" I have to agree that it is a far-fetched connection, but keep reading...

In Europe and North Africa (ITU region 1), part of the low frequency (LF) spectrum is used for broadcasting. The stations operating between 153 and 279 kHz use a tremendous amount of power, in the order of .5 to 3 megawatts. Any bird that approaches the towers of these stations will probably be cooked in flight! The high power means that a strong signal can be delivered over a large geographical area, but what other beneficial uses can be made of such a penetrating signal? For one thing, it is possible to use the transmitters to control various apparatus, such as clocks and hydro (water) meters.

For example, TDF in France carries a time signal superimposed on its regular carrier on 162 kHz. The time signal not only will keep your clock on time, but will tell you if the next day is a statutory holiday and will advance or retard the clock in the spring and fall for Daylight Savings or Standard Time.

In the UK, I am told that they also use the signal from the BBC on 198 kHz to transmit a time signal similar to the one on TDF. Using three sites simultaneously to cover the British Isles, they modulate the signals with a control signal that will set and reset your electric consumption meter to "economy" or "full" rate, depending on the time of day.

Why would an electric company be willing to offer two rates for the same product? During the day, the electric demand is at a peak and, as a producer, you would want to limit the use of electricity. So you set your rates fairly high. But between midnight and 07:00, when consumption is down, you could offer an incentive to encourage greater consumption during those hours and help equalize your total production over the full day. By doing so, you do not have to upgrade your distribution system and you can still serve your clients very well.

The only catch here is: "How do you easily control the rates charged during the off-peak hour?" One way would be to change the multiplier in the electric meter at each site. Here is where the LF signal transmitted by BBC enters the picture. Every night, part of the transmitted signal supposedly programs

### OPTIMUM WORKING FREQUENCIES (MHz) For the Period 15 June to 14 July 1998 Flux=124 SSN=82 Predictions prepared using ASAPs for Windows®

UTC	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
TO/FROM US WEST COAST																								
SOUTH AMERICA	19	18	18	18	16	15	15	14	14	12	11	11	13	14	16	17	18	19	20	20	20	20	20	20
WESTERN EUROPE	14	13	12	12	11	11	12	11	11					12	15	16	17	17	16	15	16	16	16	15
EASTERN EUROPE (P)	14	14	14	15	15	15	14	13						13	14	15	15	15	16	16	16	15	15	14
MEDITERRANEAN	17	17	16	15	15	16	14	13							15	16	17	18	18	18	18	17	17	17
MIDDLE EAST (P)	14	14	16	17	17	17	15								15	17	18	19	18	17	16	16	15	14
CENTRAL AFRICA	17	16	14	11	10	9	13	13							17	18	19	20	21	21	21	19	18	18
SOUTH AFRICA		10	10	9	8	8	11	13	13	13					16	18	20	20	20	16				
SOUTH EAST ASIA (P)	19	18	17	17	18	18	17	16	14	13	12	12	12	12	13	15	17	18	17	17	17	16	16	18
FAR EAST	18	17	15	15	16	16	15	14	12	12	11	10	10	10	11	13	14	13	13	13	15	16	17	18
AUSTRALIA	20	21	21	20	19	18	17	16	15	15	13	13	13	12	12	12	12					21	21	21
TO/FROM US MIDWEST																								
SOUTH AMERICA	17	17	17	15	14	14	13	13	12	11	10	11	13	14	16	17	18	19	19	19	19	19	18	18
WESTERN EUROPE	16	15	14	13	13	12	12	12	11					14	15	16	17	17	16	16	16	17	17	17
EASTERN EUROPE	14	13	13	14	14	13	12							13	14	15	15	15	15	16	16	16	15	14
MEDITERRANEAN	17	17	16	15	15	14	13								15	16	17	17	18	18	18	17	17	17
MIDDLE EAST (P)	13	13	15	17	16	14									15	17	19	19	18	18	17	16	15	14
CENTRAL AFRICA	17	16	14	11	10	9	13	13							17	18	20	20	21	21	21	20	19	18
SOUTH AFRICA	11	10	10	9	8	8	11	13	13	13				15	16	18	20	20	21	20	16	14		
SOUTH EAST ASIA (P)	18	16	17	17	17	16						11	12	13	15	17	17	17	17	17	17	16	16	18
FAR EAST	17	16	16	16	16	16	14	13	12	11	11	11	11	12	14	14	14	14	14	14	15	16	16	17
AUSTRALIA	19	19	19	18	18	16	15	14	14	14	13	13	13	12	12	12						21	20	20
TO/FROM US EAST COAST																								
SOUTH AMERICA	15	15	14	13	13	12	12	12	11	10	9	10	13	15	16	17	18	18	18	17	17	16	16	16
WESTERN EUROPE	15	14	13	12	12	11	11	10	9	10	11	14	16	17	18	18	18	17	16	16	16	16	15	16
EASTERN EUROPE	13	12	12	13	12	11	11						14	16	17	17	16	16	17	17	17	16	15	14
MEDITERRANEAN	15	15	15	14	13	13	12						14	15	16	17	17	17	17	17	16	16	16	16
MIDDLE EAST (P)	15	14	15	15	14								15	16	17	17	17	17	17	17	17	16	15	
CENTRAL AFRICA	18	17	14	12	10	9	14	14	13	14	15	16	18	18	19	20	20	20	20	20	19	19	18	18
SOUTH AFRICA	11	10	10	9	8	8	12	14	13	13	14	15	17	19	20	21	21	21	20	16	15	14	13	12
SOUTH EAST ASIA (P)	17	17	17	15									13	16	17	18	17	17	17	17	17	16	16	17
FAR EAST	16	17	17	17	16	14			11	11	11	13	14	15	15	15	15	15	15	15	16	16	17	17
AUSTRALIA	18	18	18	17	15	14	13	13	13	13	13	13	13	12								20	19	18

\*Unfavorable conditions: Search around the last listed frequency for activity.

the electric meters of the clients that have subscribed to this service to charge less, then reprograms them in the early morning to charge the full rate. You'd better believe the code for this programming is as well kept as the recipe for Coca-Cola!

I have been assured that it is not uncommon for subscribers to this dual rate service system to have timers installed on the washer/dryer combination, so that these apparatus will only operate after the rates have dropped.

So, take a nap and then get up to do your washing!

In North America, the LF portion of the spectrum is not as busy as it has been; could we see a similar system being implemented? Now that summer is here, you could run your air conditioner and do your wash at night on a reduced rate... Not a bad deal.

Enjoy the summer; the sun cycle is climbing and this fall season should be good for DXing.

## Play Ball!

On shortwave? Well—not really. Baseball is one sport that almost never is heard on shortwave these days. That wasn't always the case. When the Armed Forces Radio and Television Service (AFRTS) broadcast on shortwave, there were usually at least two major league games a day.

It was a unique presentation. We could hear all the famous announcers of the day because games were relayed from the teams' flagship radio stations. There were no commercials between innings. That time was filled by an AFRTS announcer who read batting averages, home runs, ERAs and gave other statistical data and background information.

But when the AFRTS moved to satellite in 1988, so did baseball. Now, except for an occasional LSU or Texas A&M college game on WRNO, mighty Casey strikes out when it comes to the ionosphere. However, that doesn't mean that the medium no longer caters to the avid sports fan.

There is more than ample sports programming on shortwave. (There's even more if you're not confined to an understanding of just the English language.) And since the quadrennial global soccer ("football" to purists) festival, the World Cup, is being played this June and July in France, this summer is an especially busy one.

### ■ Play-by-Play Descriptions

The BBC World Service, Radio Australia and Radio New Zealand International (RNZI) have extensive play-by-play commentary of various sporting events.

*Sportsworld*, on the BBC, provides continuous reports and coverage of weekend sporting events in the UK and around the world. The program airs on all streams between 1405 and 1700 on Saturdays and includes play-by-play segments of just about any sport you can name. During spring and summer, a Sunday edition of *Sportsworld* airs from 1605 to 1700. The BBC will also schedule live and taped coverage of major sporting events, such as the Wimbledon tennis championships and key World Cup matches.

*Grandstand* is Radio Australia's weekend sports program featuring full coverage and play-by-play commentaries of Australian Rules Football, rugby, cricket and soccer depending on the season. All coverage originates from the ABC domestic network and airs between 0200 and 0800 on Saturdays and 0300 and 0800 on Sundays on 9660, 12080, 15240, 15510 and 17750 kHz.

Rugby is the national sport of New Zealand and the staple of RNZI's sports broadcasts. *Sports Round-up* is the national network's flagship sports program and is relayed by RNZI weekends roughly between 2200 to 0500. And from December through March (summer in the southern hemisphere) the program is broadcast almost daily.

Both South Pacific broadcasters interrupt regular programming for marquee sporting events, sometimes freeing up special frequencies to broadcast sports simultaneously with their regular programs. Their Internet sites <<http://www.abc.net.au/ra/granhome.htm>> and <<http://www.actrix.gen.nz/biz/rnzi/sports.htm>> are regularly updated with details of upcoming sports broadcasts. Reception of both stations in the evenings in eastern North America is notably better now during the northern hemisphere's warmer weather seasons.

WRNO is virtually alone among American shortwave broadcasters in broadcasting play-by-play sports. (Although in the past, WHRI has broadcast the Indianapolis 500.) In season, WRNO broadcasts New Orleans Saints, LSU and Texas A&M football and has experimented with broadcasting LSU and Texas A&M collegiate baseball.

### ■ Sports Anthologies and Special Programs

The single best sports anthology program bar none is CBC Radio's *Inside Track*, which is relayed on shortwave by Radio Canada International. The program features insightful interviews and reports examining sports and their relationship to general society. This program is sports journalism at its very best. Unfortunately, with recent schedule changes at RCI, it has been reduced to a single broadcast on shortwave on Saturdays at 2105. Here is one place where the availability of Internet audio <<http://www.radio.cbc.ca/sports/track/>> really helps.

Another good longform sports program is the BBC's *Sports International*, which provides weekly in-depth coverage of two or three sports-related topics. Until July, though, *Sports International* is preempted by *The World of Football*, which is highlighting worldwide soccer's preparations in the runup to the World Cup tournament. These programs air in the Europe/Americas stream Wednesdays at 0630 and 1130.

Radio Australia offers a look inside the politics, controversies and business of sport in *The*

*Sports Factor*, which is broadcast Mondays at 2330 and repeated Fridays at 1505 and Saturdays at 0530 and 1930.

RNZI also has a good, if more pedestrian, weekly sports review program featuring interviews, results and highlights. *The World in Sport* airs Tuesdays at 0430, 0715 and 2135.

### ■ Other Notable Programs

Almost every station provides some coverage of national sports activity, usually as an adjunct to their news broadcasts. The following programs stand out among the rest\*:

**All India Radio** - *Sports Round-up* (a monthly review with reports and interviews) Sundays at 1345, 1830 and 2120; Mondays at 2330.

**BBC Africa** stream - *Fast Track* (weekly review of African sport) Mondays at 1615 and 1901.

**BBC Europe/Americas** stream - *Sports Round-up* (included simply because of its global breadth of coverage) Daily at 0315; Sunday at 0145; daily except Saturday at 1245, 1505 and 2245; daily except Sunday at 1745.

**BBC Caribbean Service** - *Caribbean Sport* (cricket, cricket and more cricket!) on Mondays through Fridays at 1110 on 6195 and 15220 kHz.

**China Radio International** - *Orient Arena* (reports on sports in China and Asia) Wednesdays UTC approximately 30 minutes into broadcasts to the Americas and the Pacific, Tuesdays elsewhere.

**Deutsche Welle** - *Spotlight on Sport* (a weekly background magazine on German and European sports) Fridays at 0130, 0230, 0330, 0530, 0930, 2030, 2130 and 2330.

**KTWR** - *Sports Spectrum* (focusing on Christian athletes) Saturdays at 0830 and 1030 and Sundays at 0910.

**RNZI** - *Sports World* (a one hour wrap-up of the week's sporting events in New Zealand) Saturdays at 2006.

**Radio Sweden** - *Sportscan* (weekly report on the Nordic sport scene) 15 minutes into all broadcasts beginning Mondays at 1215 up to and including Tuesdays at 0345.

**Voice of Nigeria** - *Midweek Sports* (weekly Nigerian sports magazine) Wednesday at 1930.

**Voice of Vietnam** - *Weekly Sports Report* on Tuesday (at the listener's location) in all transmissions.

Until July, good listening!

\* Days and times in UTC. Consult *Shortwave Guide* section for frequencies.

# Marine Radio Connections

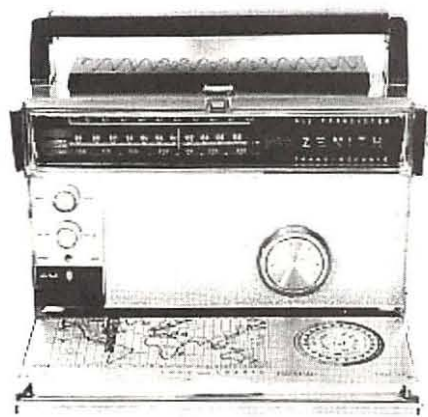
**Y**ou may be familiar with the work of James Burke, either through his *Connections* series on PBS and The Learning Channel, or perhaps through his article by the same name in *Scientific American* magazine. If you are not, I commend them to you most highly. The gist of Burke's style is to take his viewer or reader along a circuitous route to the truth on a number of subjects that turn out to be "connected" in interesting ways. What is to follow is my own feeble attempt at making such a series of connections about topics of interest to beginners in the radio hobby.

In past columns you may have heard me talk about the receiver I lovingly call "Radio One." You see, I remain in possession of the first receiver I ever owned. It was a gift from my grandfather on my sixth birthday. It is a Silvertone model 2202 6 transistor pocket AM receiver. A very spartan rig, to be sure. A simple black case with a gold colored metal front face. By collectors' standards it is not a very valuable piece, currently rated at around \$17.

But, as the radio that got me started down the path of this hobby, its value is incalculable. I can't tell you the hundreds of hours of enjoyment that radio brought to me over the years. Back then my only local station was WAZL, Hazelton, Pennsylvania. My little Silvertone was the first radio that showed me that there was more to the world than the tower I could see out of my back window. I discovered that, at night, I could hear other states, including ones in New York that carried Mel Allen doing the play by play of the New York Yankees. What six year old boy could pass up a chance to listen to a Yankees game back in the early sixties with Mickey Mantle, Yogi Berra and Roger Maris?!

But beyond even that, I probably worked my first DX, even though I didn't understand the concept until some years later. I was about eight and landed in the hospital with an appendix that needed to be somewhere other than in my body. Since these were the days before "managed care," I was stuck in the hospital for a week with little more to keep me company than a stack of comic books and my trusty Silvertone.

Out of boredom as much as curiosity, I wondered if I could hear anything on the Conelrad Channels. These were the two fre-



*The Zenith Trans-Oceanic radios are now collectors' items.*

quencies set aside for Civil Defense purposes at 640 and 1240 "kilocycles" (Yes, these were the days before Hertz received the honor). Well, one evening on 640 kc I heard a signal in the Spanish language. Now, my grown-up sensibilities say to me that it was probably a Cuban station thumbing its cold war nose at the United States. But to that little boy in Saint Joseph's Hospital, it planted a seed that would grow, overtime, into my current role as "world renowned radio sage and monitoring curmudgeon."

Yes, in case you're wondering, Radio One still works and every now and again I put a fresh 9 volt battery in it and go on a major regression trip. I own dozens of radios including some rare and valuable rigs, but if the house caught on fire, it would be "Radio One" that I would grab as I ran out the door.

I never gave much thought to collecting transistor portable radios. I had always been more of a tube set collector. However, as even the most rabid collector can tell you, tracking down some tubes to bring a sweet old receiver back to life can take an enormous amount of time, patience, and cold hard cash. Tube costs have gone through the roof in the last few years, not so much due to lack of numbers as driven by hoarding of particular, less common tubes by some collectors with an eye to profit.

I can't really blame anybody for wanting to make a buck — after all, this is the nature of capitalism. But when the price of a common tube goes from \$3 to \$50 nearly overnight, it gives even the rabid capitalist pause. But then,

if collecting was too easy it wouldn't be as rewarding when you finally bring that old rig back to life...

Don't let this little tirade scare you away from the preservation of old tube gear. There are many beautiful old receivers out there languishing in some maiden aunt's attic and just waiting for you to give them a bit of love and attention. But it is these hassles with tubes that began to turn my mind toward the early transistor rigs. Some first generation semiconductors are getting at least as rare as tubes. And this is just the place that beginners can jump in to the radio-collecting hobby for little more than pocket change.

You see, the world hasn't quite caught up to the notion that those teeny plastic radios from the early sixties have taken on some value. And those same "entrepreneurs" who hoarded the tubes by buying up stocks from TV shops and such can't take an unfair advantage over the rest of us. It is possible to still tool around a few yard sales, swap meets and estate auctions and come up with some real transistorized treasures. A few trips out on a Saturday morning could get your collections going in grand style. All you need to remember is Uncle Skip's two rules to transistor radio collecting:

**Look for the Conelrad Markings.  
Never pay more than \$5.00**

The Conelrad markings will usually indicate a radio made before 1964. You will find them, as I said earlier, at 640 and 1240 kHz. They are usually represented as little triangles or a small triangle inside a circle, which was the universal "Civil Defense" symbol from the paranoid ridden days when we practiced "duck and cover" routines in our grade school classrooms.

Most radios from this era are holding collector values in excess of \$10 and some beauties go for as high as \$500, so you're in business no matter what if you can get the unit for a fiver.

One of my best finds was a Fuji TRB-611 from 1962 with a book value of \$30. I paid the princely sum of 25 cents. Interestingly, the radio was sold along with an empty leather case from another radio of that era called a Delmonico. Now I just have to find a rig to fit the case!

If you want to bone up on actual values to haggle in the higher ranges, I recommend highly *Transistor Radios: A Collector's Encyclopedia* by David R. Lane and Robert A. Lane, Wallace-Homestead Book Company, Radnor, PA, ISBN 0-87069-712-9. This book goes deep into the fine points of getting a collection rolling. It also contains dozens of wonderful pictures for neat old pocket portables. Mine goes with me to every flea market my significant other drags me to.

These rules can be closely followed by Uncle Skip's two corollaries on transistor radio collecting.

It don't matter how funky it looks.  
It don't matter how it works.

Surprisingly, collectability is only moderately affected by poor appearance and functionality. If you're brave enough, you can often shine things up a bit and do a little light fixing. I've discovered that the most common things that goes wrong with the portables I've picked up is that the earphone jack has gone into failure mode. A few coins at the local Radio Shack can get things back on track without anything resembling a major tear-down.

Well, whenever one starts collecting in any hobby, especially the radio hobby, things can get out of hand very quickly. Before too long I had quite a few of these little puppies filling up drawers and shelves. My long suffering spouse gave me her best "it's time to consider moderation" look that has backed me off from everything from marathon monopoly games to bungee-jumping.

I agreed to reduce the size of the monkey on my back by devoting myself to a single brand of sixties era transistor radios. So, of course, I had to go with the brand with the most potential, Zenith. I am now happily trying to fill out the holes in my "Royal" series. My most recent finds have been a diminutive Royal 20 and a bigger format Royal 275.

What I didn't initially let my wife in on, with my magnanimous decision to cut back drastically on my pocket radio Jones, was that there are over 50 models in the Zenith transistor "Royal" series. So, as you can guess, it was not all that long that my wife returned to "The Look" when she walked by my radio room.

Well, as they say, a man's gotta do what a man's gotta do: I once again agreed to limit my sources of collectable radio affection. I told my dearest that I would only go after the Zenith Royal "Trans-Oceanic" series of radios. After all, there are only three models in the series with a few small variants. However, these units are going for a bit more than

pocket change, because they are larger portables that have full shortwave capability in addition to many other features. During the time they were manufactured, they were the undisputed best portable radio in the world. The older tube models have long been highly sought after.

However, recently, the three transistor models have come under collector's scrutiny. Another book for the serious collector of this whole series of Zenith portables is *The Zenith Trans-Oceanic, The Royalty of Radios* by John H. Bryant, AIA, and Harold N. Cones, Ph.D., Schiffer Publishing Company, Atglen, PA, ISBN 0-88740-708-0.

Well, I now have a Royal 3000 and a Royal 3000-I on my shelf next to my Royal portables. I'm still on the hunt for a Royal 1000 and a Royal 7000. I'm sure I can turn these up before I get "The Look" once again. After all, the first Trans-Oceanic I ever spent any real time with was my brother-in-law's Model G-500 Tube job. I couldn't talk him out of it, but then it was his "Radio One" — a gift from his father. Also, my brother-in-law is a very serious yachtsman. And as Bryant and Cones' book will teach you, Zenith's Commander Eugene F. McDonald marketed the Trans-Oceanic series of receivers to yachtsmen and

adventurers. Which leads us finally to the topic of Marine radio. How's that for a series of connections?!

Early era transistors receivers are a great place for any beginner to get started in collecting great old radios and preserving yet another generation of receivers. Oh, and, of course, you can have gobs of fun while you're at it.

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**Q.** Do NiCd batteries leak? Should they be removed from equipment in storage? (Wm. Mewes, Oakville, Ont.)

**A.** All chemical cells have the capability of causing corrosion over enough time, NiCds less so. The good ol', low cost, throw-away, carbon-zinc cells and batteries generated a well-deserved reputation for eating radios alive, although more recent casings reduce such voracious appetites.

Nonetheless, even the NiCds outgas, a sort of chemical indigestion which can be hazardous to your radio's health, so it's a good idea to remove them if they are likely to stay uncharged over an extended period of time.

NiCds last an average of about three years, but at any age, if you are getting noticeably less operational time after adequate charging, replace them.

**Q.** I was DXing with my GE Super Radio III and came across an interesting program broadcast over KGIL; where is that? (Robert Brock, Phoenix, AZ)

**A.** KGIL is in Beverly Hills, California. Before I get inundated with requests to look up call letters and locations, the most comprehensive list in print for U.S. and Canadian

AM stations is the National Radio Club's *AM Radio Log*, \$22.95 postpaid from the NRC at P.O. Box 164, Mannsville, NY 13661-0661.

**Q.** I tried unsuccessfully to access your Web site at [www.grove.net](http://www.grove.net) the other day from a library. Is there a government conspiracy to prevent people from reaching you because of your opposition to legislation censoring certain frequencies in scanners? (Name withheld)

**A.** We are alive, well, and unconspired against. Chances are one of the Internet backbone

## Bob's Tip of the Month

## Using the Select-a-tenna Properly

Indoor, inductively-coupled loop antennas really are miracle workers for mediumwave AM broadcast portables; they can bring unintelligible, weak signals out of the background noise and up to full room volume. And they aren't even physically connected!

The popular Select-A-Tenna is such a loop, so why do we get complaints from some users that it doesn't work? Ironically, when one of these is returned, it checks out just fine here. One customer even said he had tried it on six different radios before returning it, yet when it arrived, it worked perfectly on all four radios we used to test it!

I suspect that users simply don't understand the theory, and don't initially set it up properly. The Select-A-Tenna is a 13" diameter coil of wire tuned by a variable capacitor. That's it; there's nothing more inside.

It works by concentrating the incoming signal toward the radio's internal ferrite-rod loop antenna; therefore, alignment between the antenna and the radio is critical. Think of it as the electrical equivalent of aiming and focussing a telescope. It really is as easy as 1, 2, 3:

(1) Tune in a weak, barely-discernable, AM broadcaster. Set the Select-A-Tenna close to the right end of the radio, and at a slight angle to the radio.



(2) Adjust the knob on the Select-A-Tenna to the frequency of the station being received. Note as you slowly rock the knob back and forth across the signal frequency, there will be a change in the signal strength.  
(3) Move the Select-A-Tenna around to different locations to the side and back of the radio until you find the spot that couples the maximum amount of signal to the radio's internal loop. Fine tune the loop as you do this. That's all there is to it. You will need to change all settings, of course, when you change stations, or move the radio to another location.

Remember that reception on any indoor antenna may be compromised by metal in the walls, flooring, wiring, etc. and vulnerability to electrical interference from adjacent and nearby appliances (computers, fluorescent lights, TVs, etc.). An outdoor antenna is *always* superior to an indoor antenna; there are no exceptions to this, assuming the antennas are anywhere near comparable.

The Select-A-Tenna has a jack so that it can be connected to an external antenna for additional signal pickup, or to the external antenna terminals of a suitably-equipped receiver.

Hopefully, this information will be of help to those considering an indoor loop antenna, or to those who have had adverse experiences with them in the past.

links was down, you mistyped our correct address, or the library might have been using a filter program to limit Internet access to certain classes of addresses to discourage commercial use.

Conspiracy theories are very popular these days, and make entertaining movies and books, but think for a moment how impossible it would be to conceal such a wide-sweeping effort while attempting to implement it.

As a recent example, remember that it was the rapid-fire messaging by scanner users on the Internet that prevented the government from taking away 80% of all scanner frequencies in the ill-advised and poorly-written HR1964 last year.

Though you can reach us at the above address through a link, our new website address is now [www.grove-ent.com](http://www.grove-ent.com)

**Q. Are North American and British telephones electrically interchangeable?** (Wm. Mewes, Oakville, Ont)

**A.** The U.S. has set worldwide standards for wired telephone voltages and impedances, although different countries may have different ringing and DTMF ("Touch Tone") frequencies. You could listen and talk on any of these phones anywhere, but the ringing might sound different (or not sound at all), or you may have problems pushbutton-dialing out.

Questions or tips sent to "Ask Bob," c/o MT are printed in this column as space permits. If you desire a prompt, personal reply, mail your questions along with a self-addressed stamped envelope (no telephone calls, please) in care of MT, or e-mail to [bgrove@grove.net](mailto:bgrove@grove.net). (Please include your name and address.) The current "Ask Bob" is now online at our WWW site: [www.grove.net/~grove](http://www.grove.net/~grove)

If you have a second phone belonging to the system in which you are residing this should not pose a problem, and if they are pulse type (rotary dial) phones, that won't be a problem, provided your service still handles the older pulse technology which is gradually being phased out.

The same caveats cover extension phones used in office "key" systems. The phones are fine for talking and listening in intercom or home use, but the ringing and dialing require custom support.

**Q. I would like to power my battery-operated LCD clocks from an AC adaptor. Is this practical?** (Charles Pool, Water Mill, NY)

**A.** Probably not. First, you need to have the clock close to an AC outlet, or else use a long extension cord. The clock was battery operated so it could be set anywhere, independent of that power source. Second, every time there is a power outage or dropout, you will have to reset the clock (remember what your VCR clock does?)—unless you use the AC adaptor to constantly refresh a rechargeable cell in the clock.

If you still want to do it, you will have to make a "dummy" cell to fit the battery holder. You might try a length of wood dowel with metal (unpainted) thumb tacks stuck in each end to simulate the AA or AAA cell.

But what do you do for the little "button" cells? And where do you find a 1.5 VDC AC wall adaptor? You might have to install a resistor voltage divider across the output of a

higher-voltage AC adaptor to get the lower voltage so you don't burn out the clock movement.

If I were you, I'd stick with the batteries!

## Shortwave Receivers Past & Present

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## Make Your Own Signals!

Enthusiastic readers not only requested a "lower" (160-190 kHz) transmitter project, but asked for a design that included 1) inexpensive, easily-obtained components, 2) no dangerous power supply voltages, 3) frequency-stable design, and 4) built-in metering for tune-up and troubleshooting.

The circuit shown in Figure 1 should come close, and makes an ideal starter rig for the license-free lower band. (See Jan '98 column for legal operation.) The circuit was designed by Lyle Koehler, K0LR, who has agreed to share it with our readers. It is also available on Lyle's website at <http://www.qsl.net/k0lr/>, along with other related LF topics.

European amateurs note: the low power transmitter can be adapted for use on 136 kHz with two minor changes—a slight altering of the low-pass filter component values and an appropriate change in crystal frequency.

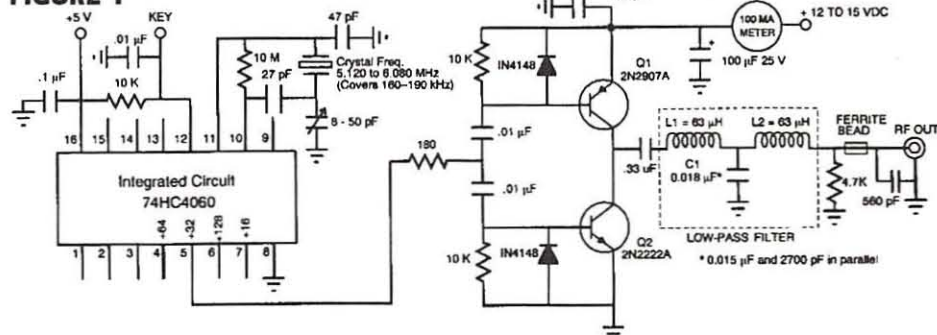
### How It Works

The transmitter circuit has three major functional areas: frequency generation, RF amplification, and output filtering. Following is a brief discussion of these stages.

The frequency generation circuit is based around a quartz crystal and a 74HC4060 Integrated Circuit (IC). The IC operates from +5 volts and functions as a "divide-by-32" device. It produces an output of 160-190 kHz (at pin 5) when crystals in the 5.120 to 6.080 MHz range are used. A trimmer capacitor between the crystal and chassis ground provides fine tuning of the operating frequency. The main advantage of a divider scheme is cost savings. 5-6 MHz crystals are far less expensive and more readily obtained than low-frequency crystals. The chip also has outputs at +16, +64 and +128, permitting use of other crystal frequencies. For example, you could use crystals in the 3 MHz range and the +16 output (pin 7) or crystals in the 12 MHz range with the +64 output (pin 4) and so on. Feel free to experiment.

The RF amplifier's job is to boost the weak signals from the crystal oscillator to a usable level. The core of the amplifier consists of two inexpensive transistors—a 2N2907A and a 2N2222A—operating in complementary fashion. These transistors, because of their design limits, "keeps you from cranking up the power to 5 or 10 watts and spoiling the fun!" says Lyle.

FIGURE 1



Simple Transmitter for the License-Free 160-190 kHz Band

Lyle finds that his transmitter operates most efficiently with about 13 volts at .077 amps (13 volts x .077 amperes = 1.0 watt). You may need to experiment with the power supply voltage to achieve the best overall efficiency. A series-resistor can be used to limit the supply current as necessary to ensure the power does not exceed 1.0 watt.

As with any transmitter, an output filter is required because the RF energy leaving the amplifier is not perfectly pure. It contains unwanted harmonics and other spurious signals that must be eliminated (or at least reduced) before reaching the antenna.

The low-pass filter (L1, L2 and C1) sharply attenuates frequencies above the intended band of operation. The ferrite bead and 560 pF capacitor across the RF output jack help to eliminate TV and FM interference. As an extra measure of protection, it is recommended that the transmitter be mounted in a metal enclosure, such as a project box.

### Putting It Together

This type of circuit is well suited to "perf" board construction and simple point-to-point wiring. Perf boards are available from many electronics suppliers at reasonable prices. Another option would be to design a printed circuit board for the transmitter, but in my opinion, that would be overkill. One "luxury" you may wish to consider is using sockets for the integrated circuit and the transistors. This allows for easy replacement should that become necessary.

Electrical construction of the circuit is straightforward. The only part that could be tricky is the construction of the low pass filter coils, L1 and L2. These are made with 60 turns of #26 enamel wire on a T80-3 (grey)

toroid form. Not comfortable working with toroids? An alternative is to wind 40 turns of #22 wire on a short piece of 1.9 inch diameter PVC pipe (or plastic pill bottle or cardboard paper towel roll). If a non-toroid method is used, Lyle recommends mounting the coils at right angles to each other to minimize coupling.

The transmitter should be placed inside a metal project box using screws and standoff spacers at the four corners of the circuit board. Exterior parts such as connectors and the ammeter can be mounted through the enclosure and wired to the appropriate points on the board.

### Component Sources

Most components for the transmitter can be purchased from Radio Shack, or from mail order suppliers such as Mouser (1-800-346-6873), or Tech America (1-800-877-0072). A very reliable source for Toroidal forms and ferrite beads is Amidon Associates, 7714 Trent street, Orlando, FL 32807 (1-800-679-3184). They provide a complete catalog with excellent tutorial information.

If you don't have any "junk box" crystals on hand, there are numerous suppliers to choose from. I noticed that Tech America has a 6.000 MHz crystal (Cat. # 900-5105) for \$1.18. This would provide lower operation at 187.5 kHz, and the price is tough to beat.

Well, there you have the basics for assembling your own Lower transmitter. We've intentionally not used a step-by-step "Heathkit" approach to this project. The idea is to encourage ingenuity, experimentation, and fun! Next month we'll discuss powering up the transmitter and connecting it to an antenna system. See you then.

## Legal pirates?

Over the last couple of years, there's been a lot of unlicensed activity on the FM band. A California federal court's refusal to issue an injunction against a Bay-area FM pirate seems to have led to an upsurge in unlicensed broadcasting in other U.S. cities. I'm sure some pirates operate only to thumb their noses at the government and would probably take up something else if their broadcasts were suddenly legalized. But others attempt to serve specific audiences and would be happy to operate legally. The FCC has now received two petitions urging the creation of a "low-power FM broadcasting service"; if adopted, this would allow many existing FM pirates to obtain legal licenses.

Both petitions make prominent mention of concentration of ownership of licensed stations in light of recent relaxation of the multiple-ownership regulations. And both proposals contain provisions the petitioners believe will ensure that low-power radio stations provide service to local communities.

The most comprehensive of the petitions was filed in February by J. Rodger Skinner, Jr. of Florida. He proposes three types of low-power FM stations:

- LPFM-1: 50-3000 watts.
- LPFM-2: 1-50 watts.
- LPFM-3: 20 watts or less.

Most existing broadcast regulations would apply to LPFM-1 stations. The major difference between a LPFM-1 and a "regular" Class A station would be a requirement that the owners reside within 50 miles of the station's transmitter. LPFM-1 stations would be a "primary" service, protected from interference both from other LPFMs, and from new "regular" stations.

LPFM-2 and LPFM-3 would be "secondary" services. Except for those necessary to prevent interference to other stations, most



*It's a little early to be thinking about college football, but here goes anyway... KKAR-1290 Omaha is that city's outlet for the games of the Nebraska Cornhuskers.*

FCC regulations would not apply to these microstations. Stations could lose their channel if needed for a new regular station or LPFM-1.

LPFM-3 would be a special category for temporary stations at special events. These licenses would not exceed 10 days and would face only minimal regulation.

A second petition was received from Nickolaus and Judith Leggett of Virginia and Donald Schellhardt of Connecticut. Their petition calls for the assignment of one AM and one FM channel for a "Microstation Radio Broadcasting Service." Power limits aren't specified, but a maximum antenna height of 50 feet is proposed. One owner would be limited to a maximum of five microstations, each of which must be at least 50 miles from any other commonly-owned stations.

The FCC's Mass Media Bureau has been maintaining several Internet documents on the subject of low-power broadcasting. Point your browser at <http://www.fcc.gov/mmb/asd/decdoc/engrser.html#LOW> for more information. The Skinner petition has been assigned reference number RM-9242, and the Leggett/Schellhardt petition number RM-9208.

### ■ Bits and Pieces

• George Hamer of New York is working on a Beverage antenna, as described in January *American Bandscan*. He asks, "I've heard of use of a carbon potentiometer for termination of a Beverage, is this better or about the same?"

Yes, I've heard of this being done as well. The 470-ohm resistor I used in mine is not exactly the right value. In fact, because of differences in ground conductivity and receiver designs (among other things) the ex-

act correct terminating resistor is different for every antenna. If you use a 1000-ohm potentiometer as a terminating resistor, you can adjust it for maximum rejection of signals coming from the "wrong" direction, and correct for these variations.

However, there are two major problems with using a variable terminating resistor. First, variable resistors aren't meant to be installed outdoors. They aren't sealed; moisture and dirt can get inside and cause the resistance to change drastically. Fixed-value resistors are fairly well sealed and won't change value unless abused by application of excessive voltage (not likely on a receiving antenna).

Second, by definition, the terminating resistor is as far away from your radio as possible! This makes proper adjustment rather difficult. If you really do want to try a variable terminating resistor, you'll need a friend at your receiver with a two-way radio to tell you when you've found the correct setting. In my opinion, 470 ohms is close enough!

• The expanded-band news this month is... no news at all. KRIZ-1620 Seattle is being heard up and down the West Coast, but not much of anywhere else. KKSL-1640 Portland was expected on, but so far I've not seen any reports of it. WTDI-1670 in Wisconsin has been delayed until May; it may or may not show up by the time you read this.

• I've changed Internet providers and my email address. If you're noticing something interesting on the domestic bands, please write at P.O. Box 98, Brastown NC 28901, or to my new address w9wi@bellsouth.net. Good DX!

### AM CALL CHANGES

The following AM stations have changed callsigns in the last month:

KBCO-1190	KVCU	Boulder, CO
WWRC-980	WTEM	Washington, DC
WOTS-1220	WOMN	Kissimmee, FL
WNGO-1320	WIVR	Mayfield, KY
WTEM-570	WWRC	Bethesda, MD
KIRK-870	KAAN	Bethany, MO
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## FM Micropirates Busted; Thousands Still Active

Despite several recent busts of FM micropirate broadcasters in the United States, many hundreds of stations remain active. FCC actions thinning the ranks of micropirates have been increasing, but at a rate slower than the sign-on activity of new operations.

MT reader Keith Russell notes that despite an investigation and notices from the FCC, KAW-FM still puts out 10 watts from Lawrence, Kansas. Angel Dones' Radio Maranatha on 89.9 MHz in Cleveland, which generated interference complaints from licensed NPR station WKSU in Kent, Ohio, had its equipment confiscated by the FCC. But, rap music group Bone Thugs-N-Harmony simultaneously activated another Cleveland micropirate on 99.9 MHz with a black contemporary format.

The Los Angeles Times profiled Steven Dunifer's continual battle with the FCC from his Radio Free Berkeley base on 104.1 MHz. Dunifer holds two consecutive federal court victories that denied FCC requests for injunctions to close him down. MT reader Thomas Risher points out that the Times defines pirate radio in an FM context, ignoring shortwave. The FM and shortwave sides of the pirate radio movement remain somewhat distinct in the USA, with limited contact between the two.

### ■ Unlicensed Radio Web Sites

Several new or updated internet web sites contain useful information for pirate and clandestine DXers. The largest Free Radio site in North America, the Free Radio Network, generated dozens of reports to MT when their site vanished on April 1, replaced by a message that the site had been closed down by an FCC investigation.

Fortunately this was a one day prank on April Fool's Day! So <http://www.frn.net/> is still the best place to go for detailed internet pirate information. Another new site, The Pirate Monitor, uses <http://www.geocities.com/CapitolHill/Lobby/2395/390.html> for a page graphically dominated by a Collins R-390A's front panel.

A new pirate site at <http://www.radiodiversity.com/> integrates FM pirate microcasting with other community radio activities. It's operated by Americans for Radio Diversity. A. J. Michaels of Action Radio coordinates a Fed-Watch e-mail listserver forwarding updated FCC activity related to unli-

**Free Radio Ravens QSL**

We here by confirm Your reception report

To: <u>George Zeller</u>	
Time: <u>15.18-15.44</u> UTC	
Date: <u>Jan. 25 98</u>	
Frequency: <u>6550</u> kHz	
Sig: <u>3.5 43</u>	

Radio Ravens, SRS, Östra Porten 29, 442 54 Titterby, Sweden  
radio\_ravens@hotmail.com

### QSL from Europirate Radio Ravens

censed broadcasting. For this free service, send an e-mail to [FED-Watch@webtv.net](mailto:FED-Watch@webtv.net) with the word *subscribe* in the message text.

Among clandestines, the Cuba MegaLinks Center lists numerous links to Cuba, including historic clandestine radio operations. It uses <http://www.laker.net/nike/megalinks.html> as its URL. An Anti-Castro Historiography (formerly the Anti-Castro Clandestine Radio Page) still uses <http://www.geocities.com/CapitolHill/Lobby/8115/> as its contact point. Napoleon Williams has opened a web site for his political action pirate/ clandestine microcaster in Illinois, with a <http://burn.ucsd.edu/~blr> URL.

### ■ Shortwave Pirates Active

Activity levels on the North American pirate bands continue at an extremely robust pace in 1998. The threatened use of 6955 kHz by licensed station WGTG in Georgia has been intermittent, so this frequency (+/- 30 kHz) remains the location for most pirate transmissions. Interestingly, a pirate version of WGTG has materialized, with a slogan of "With Glory to Gumbly!"

The return of K-2000 has been big news. This pirate, with a hilarious format of drama parodies of DXers and DXing, has a deserved reputation as the most elaborately produced unlicensed broadcaster in North America. If you hear them, reports go to PO Box 146, Stoneham, MA 02180. Another veteran station, Take It Easy Radio, is airing an ad plugging *Monitoring Times* magazine.

On the QSL front, Europirates Radio Ravens and the Voice of South Dublin have both been verifying recent North American pirate relays. Conversely, new station Radio Kenny and its

falsetto format has announced no address. Another new station, Supercalifragilisticpealidocious (whew!) broke the record for station name length. It asked for reception reports via The ACE web site at <http://www.frn.net/ace/> on the internet.

### ■ Mid America Conference?

Longtime DXer Carl DeWhitt announces that several DXers are organizing a Mid America Communications Conference. Their goal is to hold a DXing event in the midwestern USA, probably in Oklahoma or Nebraska. Dates and format are still uncertain, but if you are interested, e-mail is welcome at [ki5sf@hit.net](mailto:ki5sf@hit.net) address.

Carl's idea draws inspiration from the Winter SWL Festival, held in mid-March at the Holiday Inn Kulpville in suburban Philadelphia, PA. The 1998 event (including a pirate radio forum with Andrew Yoder and yours truly George Zeller) is past, but it's not too early to start thinking about the 12th annual Fest scheduled for March 12 and 13, 1999. Information is available at either [http://www.trsc.com/swl\\_fest.html](http://www.trsc.com/swl_fest.html) or via PO Box 591, Colmar, PA 18915.

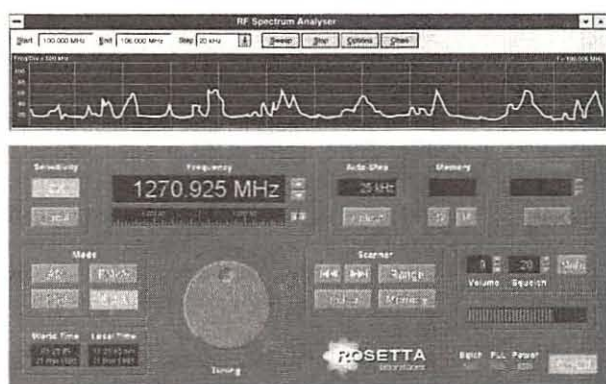
### ■ Thanks!

Reader input is always welcome via PO Box 98, Brasstown, NC 28902, or via the e-mail address atop the column. We thank the following radio hobbyists for material used this month:

Shawn Axelrod, Winnipeg, Manitoba; Ranier Brandt, Hoefer, Germany; Dean Burgess, Manchester, MA; Jerry Coatsworth, Merlin, Ontario; Ross Comeau, Andover, MA; Carl DeWhitt, Ponca City, OK; Ken Dowst, Hartford, CT; Joseph Fialka, Davison, MI; Joe Filipkowski, Providence, RI; Harold Frodge, Midland, MI; Nick Grace, Washington, DC; Paul Griffin, San Francisco, CA; William Hassig, Mt. Prospect, IL; John Hollowell, Port Republic, MD; Rich and Talea Jurens, Katy, TX; Zacharias Liangas, Italy; Chris Lobdell, Stoneham, MA; Greg Majewski, Oakdale, CT; Bill McClintock, Minneapolis, MN; A. J. Michaels, Pittsburgh, PA; Kevin Nauta, Grand Rapids, MI; Gary Neal, Sugar Land, TX; Michael Prindle, New Suffolk, NY; Al Quaglieri, Albany, NY; William Rhodes, San Diego, CA; Thomas Risher, Whittier, CA; David Robbins, Jerusalem, Israel; Robert Ross, London, Ontario; Keith Russell, Kansas City, MO; Lee Silvi, Mentor, OH; Tony Truong, Austin, TX; Sue Wilden, Columbus, IN; Napoleon Williams, Springfield, IL; Niel Wolfish, Toronto, Ontario; Xcitor, Washington, DC; and Andrew Yoder, Blue Ridge Summit, PA.

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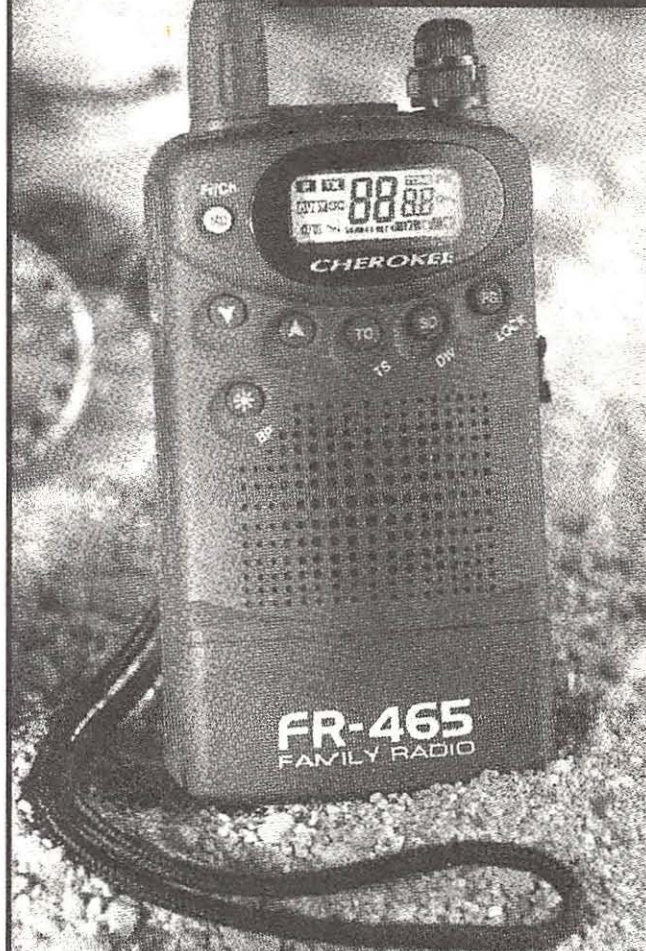
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### Classic Gear

For many years, it was possible for a newcomer to amateur radio to purchase reasonably priced, decent, classic gear at any hamfest. I'm sorry to say those times have gone the same way as 25-cents-per-gallon gasoline!

As an example, at a recent hamfest I saw a Heathkit HW-8 selling for three times its original price! (See photo below.) I built an HW-8 when they first came out in 1975 or so, and was delighted with it; I actually worked all continents and a good number of countries with this little 3 watt transceiver. Seeing its value, I dusted mine off and got it working again. (No, I would not consider selling it!)

In short, any gear that was popular 20 or more years ago is bringing a fairly high price today. There are still some bargains, but they are getting harder to find.

In your search for a reasonably priced rig, let me suggest you (1) get to the hamfest early enough to find the bargains before the collectors; (2) go to the smaller hamfests, and (3) don't overlook flea markets and yard sales (I purchased a Collins R-388 at a yard sale for just \$20). Ask around among the local hams; frequently older hams are willing to sell decent gear to a newcomer just to see them get on the air. And watch the items for sale in your local newspaper. Household auctions also oftentimes offer up usable gear at modest prices. For example, a complete station consisting of an HT-32 Hallicrafters transmitter and SX-101 receiver, plus a box of goodies went for fifty bucks at an auction just a few months ago.

Good Hunting!

#### ■ New Gear

Icom recently announced the introduction of the IC-T8A tri-band Handheld transceiver(right). This is the first multiband handheld to include six meters in the band lineup as well as 2 meters and 440 MHz, plus it is capable of receiving on 150 and 450 public safety bands, FM and TV broadcast. The transmitter features five watts output.

The T8A also features 123 memory capacity, including 10 scan edges and ONE call channel per band. Standard features include tone squelch, pocket beep, and auto-squelch, auto power saver, electronically controlled volume and direct keypad input.

Icom calls this the world's smallest full-featured tri-band handheld. At 2-9/32 inches wide, 4-7/32 inches high and 1/8 inches deep, it surely deserves the title.

This is a very interesting looking piece of hardware. For more info contact Icom America, 2380 116th ave NE, Bellevue

WA 98004 or check their web site at <http://www.icomamerica.com>.



*The Icom IC-T8A claims to be the world's smallest HT.*

member the ARRL VHF contest and Field Day are held in June. A handheld, portable beam or gain antenna coupled to a rare grid square can make for a lot of fun during the VHF contest.

While most hams join with their clubs for field day, a single operator with a portable or mobile rig can have a ball, too. Get in on both contests. Try to schedule some operating time from any rare counties you may be traveling through during vacation time if possible (14,336 MHz is the county hunters net frequency.)

In years past I have taken my QRP rig with me on my canoe trips and handed out many QSOs and photo QSLs from some of America's most scenic places.

Another relaxing and fun mode is backyard operating. Take the rig out to the pool, patio or deck and chat with the gang while enjoying the best of summer.

And now is the time to clean up the antenna farm, add to it and get ready for next winter's DX season.

#### ■ Write a Letter

I like hearing from you and learning about what you are doing. While you are about it, how about dropping me a line and telling me of your activities and what you want to see in this column? Next month's column is based on a letter and subsequent communication with a reader.

Happy hamming to one and all. 73 de Ike Kerschner, N3IK



*Did you put together a Heathkit HW-8? I've seen it selling at three times its original price!*

#### ■ Phase 3D

Latest news says Phase 3D may be launched by midsummer. AMSAT has had to rebuild the satellite to withstand higher environment levels. Work has been started and may be complete at this time.

#### ■ Summertime

And the hamming is fun! Don't leave the ham rig home when you go on vacation. Re-

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# Icom's IC-M1 VHF Marine Transceiver

The Telecommunications Act of 1996, which became law on Feb. 8, 1996, brought about some fundamental changes in the licensing marine VHF radios. For the first time ever, recreational boats which do not travel in international waters, do not need a license to operate a marine VHF radio. Previously an FCC-issued license and license fee were required.

Marine VHF radio (156-162 MHz) is used for voice communications with other ships and coast stations over short distances. The marine VHF channels are divided into operational categories, based on the types of messages sent on those channels. The chart below summarizes these channels by type of message and appropriate channels. These are the **only** channels that you may use, even if your radio has more channels available.

Recently, I got my hands on a dandy marine VHF handheld radio, the Icom IC-M1. This 5-watt handi-talkie is preprogrammed with every USA, Canadian and international marine VHF channel, as well as 10 weather channels. Measuring just 2-1/16 inches wide by 5-3/32 inches high by 1-3/16 inches deep, the IC-M1 weighs just 9.9 ounces. The construction is very robust and the entire unit is designed to withstand torrential downpours, heavy seas, and even complete submersion.

There are only six well-spaced buttons, a speaker/microphone, and a large, easy-to-read liquid crystal display on the front of this radio. On the left side, there is a push-to-talk button and another button for defeating the auto-squelch. On top of the radio, there are knobs for channel selection and volume control and a rubber ducky antenna. When you turn the volume up all the way, you get a lot of audio that can be readily heard, even over the drone of a boat motor.

Small enough to be stuffed in a jacket pocket, the IC-M1 can be operated with one hand, even in gloves. It takes about eight seconds to learn the basic controls without looking at the instruction manual. Among the goodies that this radio delivers: high-speed scanning (28 channels/sec.), selectable dual and tri-watch, auto weather alert during standby or scanning, and instant access to channel 16 and channel 9. Because this radio has so many functions and so few controls, Icom has wisely chosen to include a waterproof "cheat sheet" that can be pasted to the back of the

transceiver for quick reference.

Suggested retail price of the Icom IC-M1 is \$436, but discounters will have them for less. For more information, call Icom technical service

department 1-425-454-7619. For more information about marine VHF radio, call the FCC toll-free information line at 1-888-CALLFCC or visit the FCC website at [www.fcc.gov](http://www.fcc.gov).

## MARINE VHF RADIO CHANNELS

Type of Message	Appropriate channel(s)
<b>Distress Safety and Calling</b> - Use this channel to get the attention of another station (calling) or in emergencies (distress and safety).	16
<b>Intership Safety</b> - Use this channel for ship-to-ship safety messages and for search and rescue messages and ships and aircraft of the Coast Guard.	6
<b>Coast Guard Liaison</b> - Use this channel to talk to the Coast Guard (but first make contact on Channel 16).	22
<b>Noncommercial</b> - Working channels for voluntary boats. Messages must be about the needs of the ship. Typical uses include fishing reports, rendezvous, scheduling repairs and berthing information. Use Channels 67 and 72 only for ship-to-ship messages.	9(fn6), 68, 69, 71, 72, 78, 79(fn4), 80(fn4)
<b>Commercial</b> - Working channels for working ships only. Messages must be about business or the needs of the ship. Use channels 8, 67, 72 and 88 only for ship-to-ship messages.	1(fn5), 7, 8, 9, 10, 11, 18, 19, 63(fn5), 67, 72(fn7), 79, 80, 88(fn1)
<b>Public Correspondence (Marine Operator)</b> - Use these channels to call the marine operator at a public coast station. By contacting a public coast station, you can make and receive calls from telephones on shore. Except for distress calls, public coast stations usually charge for this service.	24, 25, 26, 27, 28, 84, 85, 86, 87, 88(fn2)
<b>Port Operations</b> - These channels are used in directing the movement of ships in or near ports, locks or waterways. Messages must be about the operational handling movement and safety of ships. In certain major ports, Channels 11, 12 and are not available for general port operations messages. Use channel 20 only for ship-to-coast messages. Channel 77 is limited to intership communications to and from pilots	1(fn5), 5(fn3), 12, 14, 20, 63(fn5), 65, 66, 73, 74, 77
<b>Navigational</b> - (Also known as the bridge-to-bridge channel.) This channel is available to all ships. Messages must be about ship navigation, for example, passing or meeting other ships. You must keep your messages short. Your power output must not be more than one watt. This is also the main working channel at most locks and drawbridges.	13, 67
<b>Maritime Control</b> - This channel may be used to talk to ships and coast stations operated by state or local governments. Messages must pertain to regulation and control, boating activities, or assistance to ships.	17
<b>Digital Selective Calling</b> - Use this channel for distress and safety calling and for general purpose calling using only digital selective calling techniques.	70
<b>Weather</b> - On these channels you may receive weather broadcasts of the National Oceanic and Atmospheric Administration. These channels are only for receiving. You cannot transmit on them.	Wx-1 162.55 Wx-2 162.4 Wx-3 162.475

### Footnotes to table

1. Not available in the Great Lakes, St. Lawrence Seaway, or the Puget Sound and the Strait of Juan de Fuca and its approaches.
2. Only for use in the Great Lakes, St. Lawrence Seaway, and Puget Sound and the Strait of Juan de Fuca and its approaches.
3. Available only in the Houston and New Orleans areas.
4. Available only in the Great Lakes.
5. Available only in the New Orleans area.
6. Available for Intership, ship, and coast general purpose calling by noncommercial ships.
7. Available only in the Puget Sound and the Strait of Juan de Fuca.

Special to trailer boaters: To legally use a marine VHF radio on land requires a special license, called a marine utility station license. Without that license, it is **not** legal, for example, to use a marine VHF portable in your tow vehicle to communicate with someone driving your boat to the launching ramp.



## What's Wrong with my Dipole?

**R**ecently a friend told me that he had measured his center-fed, horizontal, halfwave, high frequency antenna for both feedpoint SWR and impedance. He was quite surprised to find that he got readings far from what he expected. And the antenna was not resonant at the frequency for which he had cut it! He measured values like 15-ohms impedance, and an SWR of 5:1.

He had cut the antenna as the instructions in his construction article had indicated that he should, and so he expected the "textbook" values of around 70-ohms impedance and a low SWR around 1:1 or so. In frustration he called me, and asked "What is wrong?"

Many of us who experiment with antennas have gone through this same frustration, but we live to see a brighter day if we persevere. So let's discuss some of the possible reasons why my friend got such confusing measurements from his antennas.

One of the first things we learn as we seek answers for such dilemmas is that the textbook values given for antenna impedances are for an antenna spaced far from any conductors that might affect its operation. Antennas in "free space" (like outer space), when fed with the appropriate feedline, have the textbook-given values of resonance, feedpoint impedance and SWR.

But antennas in the real world (usually our back yard or roof) are generally close enough to some other conductive object that they are affected by that object. Their resonant frequency and their impedance, and therefore their SWR, changes as a result. Metal towers, metal fences, metal buildings, the earth itself, and even green or wet vegetation can couple to the antenna's near field and cause these variances from free-space operation.

By far the biggest conductive object usually affecting an antenna's performance is the earth beneath the antenna. Note that in fig. 1 we see that the radiation resistance of a horizontal, halfwave dipole can vary from around 0 ohms to almost 100 ohms depending on its height above the earth. Although radiation resistance and feedpoint impedance are not the same thing, for a simple antenna fed at a current loop (as the center-fed dipole is), their value is close to equal. Obviously then, we should not always expect the center feedpoint impedance on a halfwave dipole to be close to 70 ohms. As fig. 1 shows we seldom find 70-ohms of feedpoint impedance in our practical backyard installations unless we are careful to make the antenna's height above ground appropriate.

### ■ Uh Oh!

To complicate matters more when the antenna's height is about 0.2 wavelength or more above the ground, then the *kind* of earth below the antenna has significant effect on the "electrical height" of the antenna above ground. "Electrical ground," sometimes called "radio ground," is the depth (0 to many feet) below the ground's surface at which radio waves coming from the antenna seem to be reflected upwards.

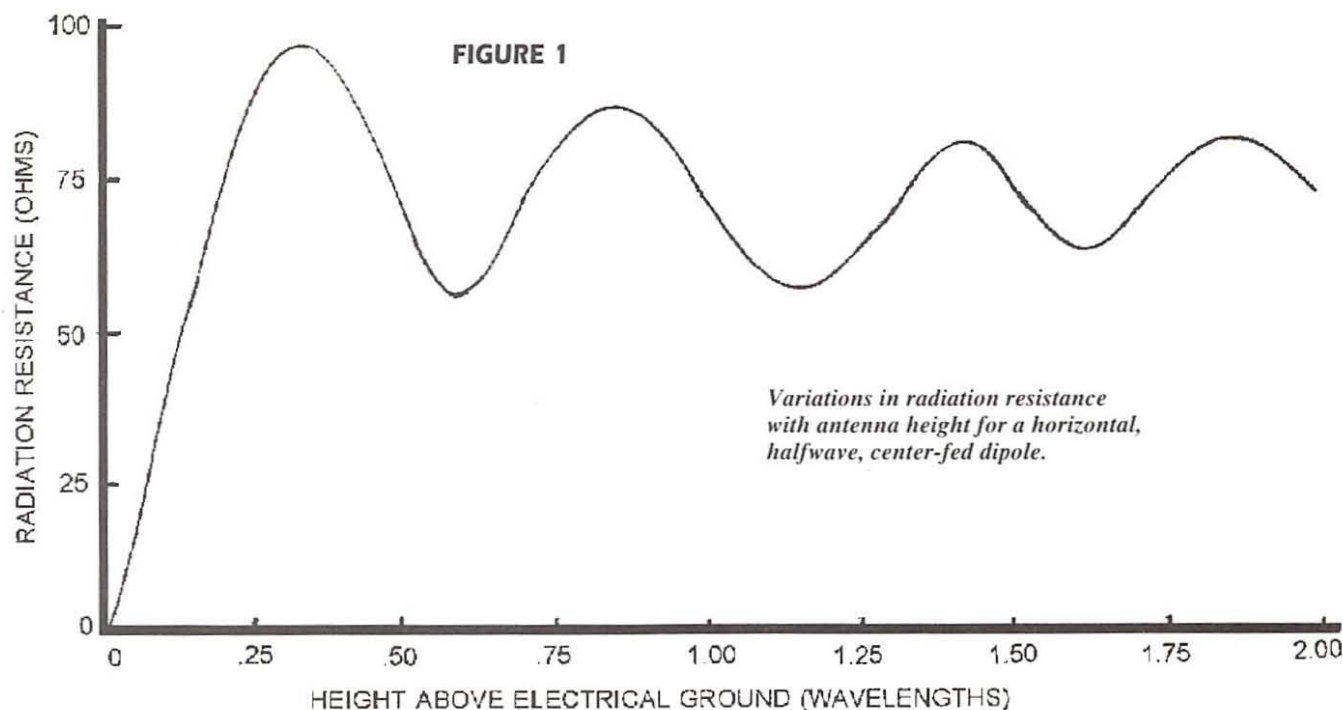
If the earth below the antenna is a perfect conductor, then the surface of the earth is also the electrical ground. Above damp earth or water (these are decent conductors compared to dry ground) the electrical height of the antenna will be close in value to the antenna's height above the surface of the ground. But for dry, sandy or rocky soil (which has poor conductivity) the electrical ground can be many feet below the ground's surface. The height used for fig. 1 then would be measured from the antenna down to the *electrical-ground* level below the earth's surface.

The length of .2 wavelength in air can be found by:

$$197/\text{freq}(\text{MHz}) = \text{Length}(\text{feet})$$

or

$$60/\text{freq}(\text{MHz}) = \text{Length}(\text{meters})$$



These formulas tell us that at 20 MHz and higher fig. 1 will give good estimates of feedpoint impedance values with antennas as low as 10 ft high. But down around 3.5 MHz our antennas would have to be up over 50 ft high for us to ignore the effects of ground conductivity variations on the validity of fig. 1. That's higher than the vast majority of us can afford to hang our skyhooks!

The effects of different kinds of earth are beyond the scope of this present discussion. More on these effects can be found in the *ARRL Antenna Book*.

#### ■ And So ...

Most of us have exciting results with our antennas in spite of the fact that many of us can't get them up more than 10 to 20 feet in the air. We get sufficient signal to the receiver for pretty decent reception with most antennas. This in spite of some pretty scary SWR values at that junction, and the fact that the antennas are not resonant at the frequencies for which we designed them. But, if you want optimum performance, fig. 1 can help.

If you are using the antenna to transmit then you are usually concerned with the SWR value at the junction of the feedline and the transmitter output. That should be low in order to feed RF power properly to the line and to avoid damage to the transmitter's final stage. The SWR at the antenna feedpoint-feedline junction is more important also for transmitting use than for receiving use, but this importance is reduced by using low-loss feedline.

Most hams ignore the modest (or sometimes even large) SWR values at this feedpoint-feedline junction with no serious loss of communications potential. But again, for optimum results, fig. 1 can help.

#### ■ But Wait!

Quite apart from variations in feedpoint impedance there is another important reason to think about your horizontal antenna's height. A horizontal HF antenna spaced a half wavelength from electrical earth has a radiation reception pattern much more conducive to long-haul DX performance than one with less height. The very same HF antenna spaced only a quarter wavelength above electrical ground favors close-in work, suitable for communications with nearby states.

Radiation reception patterns for antennas at different heights are shown and discussed in the *ARRL Antenna Book*.

#### ■ In Summary:

It takes more than cutting an antenna to length by a formula to get textbook measure-

ments of resonance, feedpoint impedance, and SWR results. With sufficient attention to detail it is possible, but whether the care required to get these results is worth the effort it sometimes takes depends on your situation. For receive-only applications our reception is often quite satisfactory although we have measurements rather different from the textbook values we often read about (but seldom find).

### RADIO RIDDLES

#### ■ Last Month:

I said that scatter propagation might well have been mentioned as an application where the transmitting antenna affects the route of the signal to the receiving antenna. Why? What is scatter propagation?

Well, scatter propagation results when highly directive, very high-gain antennas are aimed into the troposphere at a point about half way between the stations trying to communicate. At the frequencies utilized (150 MHz or higher), there is a scattering of the signal which includes the over-the-horizon direction. This tropospheric scattering can provide communications over distances up to several hundred miles. With high power, very high-gain antennas, and sensitive receivers, this method can provide reliable communications.

#### ■ This Month:

We've been talking about the SWR at the junction of an antenna feedpoint and the feedline. In practice we usually measure SWR at the end of the feedline near the receiver or transmitter. Does this give us the value of the SWR at the antenna feedpoint-feedline, or is it a different thing? Why or why not?

You'll find an answer for this month's riddle, and much more, in next month's issue of *Monitoring Times*. 'Til then Peace, DX, 73



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## Network Your Computers

If you have two or more computers around home, shack, or office, there are dozens of reasons to connect them into a Local Area Network. A LAN lets you work at one machine with access to the resources of the other(s). Just consider: all hard, floppy, and CD drives, folders and files, and even printers can be instantly available to any computer on a network. There are even ways for one modem to serve multiple computers on a network — All this for roughly \$50 and two computers running Windows 95 or later.

At typical LAN speeds of 10-Mbps, you really can't distinguish files and programs on one computer from those on the other: networks are fast! The power of a computer network staggers the imagination. If you're reluctant, use this article to start considering the numerous reasons to take the leap.

Multiple computers are becoming common around home and office these days. Radio hobbyists frequently use old 386 or 486 computers in the shack, while games and checkbook balancing are done on a Pentium in the family room. Without a network, these two machines can be light-years apart. Networked, the power vastly exceeds the sum of the parts. Pentiums are "the thing," but 486 and lesser computers are still great for the radio room, if for nothing else! And, they're inexpensive!

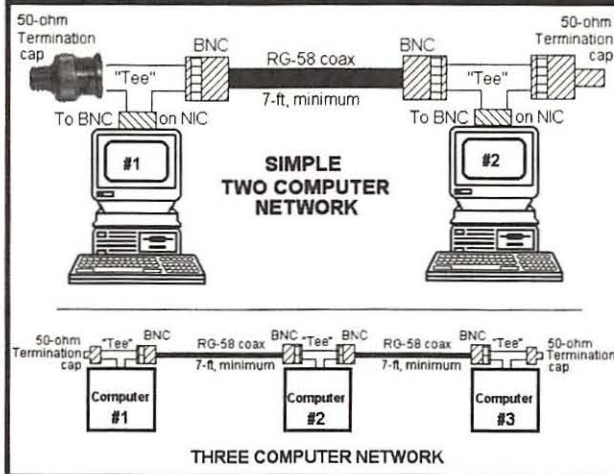
Do you "back up" important files? It's cheap and easy if you have two or more computers on a network. Each computer can hold backup folders for the rest, and what's more, the backup process can be automated.

Time was when networking was the domain of highly paid, propeller-headed gurus. Even now network engineers command \$90/hr and up, but that doesn't mean you have to hire one! Do it yourself!

### ■ Preparing for a LAN

Most radio hobbyists are capable of installing and using a LAN. Here is all that's needed for an easy, high-performance peer-to-peer Ethernet LAN:

FIG-1: NETWORK CONNECTIONS



1. Two or more PC-386/compatibles or better
2. Running Windows 95, Windows NT, or Windows 98 (see text for others)
3. One BNC Ethernet Network Interface Card (NIC) per computer (also called a LAN adapter)
4. One BNC "tee" adapter per computer.
5. Two 50Ω BNC terminator caps
6. One length (to fit) of RG-58 coaxial cable with BNC connectors on each end, per the first two computers, and one additional length per each additional computer.

There are several ways to network two or more computers, but the easiest and cheapest is built into Windows For WorkGroups 3.11, Windows 95/98, and Windows NT. Microsoft's Workgroup Add-On for MS-DOS even lets you network XT and AT computers that use MS-DOS. Other operating systems, including OS/2, Macintosh, and the various flavors of Unix also have built-in networking, but this article attempts to keep it simple. Windows networks are simple and very effective.

### ■ About Our Easy LAN

Our LAN is an Ethernet 10Base-2 (also called thinnet), using RG-58 A/U 50Ω coaxial cable up to maximum lengths of 170-ft. This is a "peer-to-peer" network, because

there is no dedicated server; each computer acts as both a client and a server.

The Network Interface Card (NIC) for each computer must come with a female BNC to which you add a "tee" adapter (RS#278-112) for RG-58 cables to go to adjacent computers. Each unused end "tee" connection of a 10Base-2 LAN must have a 50Ω terminator BNC cap.

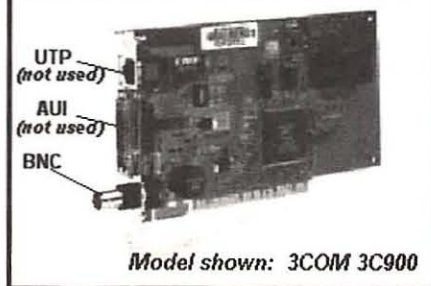
A 10Base-2 network runs at 10 Mbps for great performance. Newer networks run at 100 Mbps. The latest, at 1-Gbps, is barely out of the R&D labs. These not only cost more but they're overkill for small office and home networks, anyway.

### ■ The Details

Figure 1 shows how to connect a typical BNC/coax Ethernet LAN. You're a radio hobbyist, so you know all about BNC connectors. Just correctly install the BNC hardware. BNC LANs are susceptible to disruptions caused by cable and connector problems.

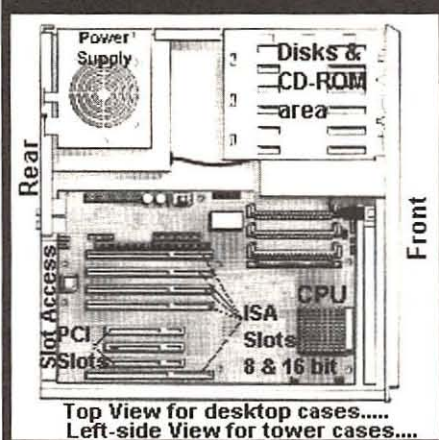
Figure 2 shows a typical network interface card (NIC). There are many kinds, and a wide variety of prices, but all do about the same thing. Your NIC should have the "combo" feature where two or three different outputs come on one card: BNC, UTP (universal twisted pair), and AUI, (not important to us.) UTP, (characterized by an 8-pin RJ-45 modular jack), is in wider use than the BNC type. We won't get into UTP (10Base-T) LANs now, but your NIC should have the RJ-45 jack for future growth and enhanced networking

FIG-2: TYPICAL COMBO NIC



Model shown: 3COM 3C900

FIG-3: CARD SLOT LOCATIONS



options after you become more experienced. For now, BNC/coax is the simplest, most economical network.

By the way, NICs are readily available for around \$20, and in no case should you pay more than \$50 for one. Specify an "NE-2000-compatible" 16 or 32-bit 10-Mbps Ethernet card. If your computer is a Pentium or equivalent, then get a 32-bit "PCI" type so long as your computer has a spare PCI slot.

If your computer is a 486 or 386, then you'll need an "ISA" card, which comes in 8-bit and 16-bit styles. There is usually no good reason to settle for an outdated 8-bit card, so insist on a 16-bit NIC. Eight-bit cards are necessary for old PC/XT/8086/8088 machines, but that's beyond the scope of this article. AT/286 computers and up have 8 and 16-bit slots.

Figure 3 shows the approximate appearances of ISA and PCI card slots in a typical computer. Your NIC plugs into one of these slots. First, of course, remove the mating slot cover strip from the back of the chassis. Save the screw to secure the NIC after it is plugged into the slot.

Avoid the bottom slot of a tower case computer for the NIC because the RG-58 and "tee" can be too constricted and cause pinches and crimps in the cable, not to mention making access difficult. Relocate other cards as needed to keep the NIC out of a bottom slot. This caution doesn't apply to desktop boxes where all slots are pretty much equally accessible. It is important to keep the coax from pinching, twisting, and straining at the BNC connector.

### The Steps

1. Install an NIC in each computer.
2. Attach a BNC "tee" to each NIC's output BNC.
3. For a two-computer network:
  - A. Attach one 50 $\Omega$  termination cap to each "tee"

- B. Connect a 7 ft. or greater length of RG-58 coax between the "tee's" of each computer
4. For a three or more computer network:
    - A. Designate two computers as "end" units, and the rest as "middle" units
    - B. Attach one 50 $\Omega$  termination cap to the "tee" on each "end" computer.
    - C. Connect a 7 ft. or greater length of RG-58 coax from "tee" of an "end" computer to the "tee" of the closest computer. Connect a 7 ft. or greater length of RG-58 coax from that "tee" to the next computer, etc., etc.
  5. Turn computers on; boot to Windows; and follow on-line and written help for adding and configuring a network.

### Network Setup

Setting up a network is easy, particularly if you're using Windows 95 or later and if your NIC card is the PCI "plug 'n play" type. Consult the Windows Help under "network," and follow the instructions that come with the NIC to install the card and software.

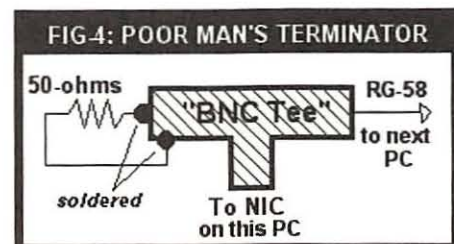
When you set up the Windows networking components, choose NetBEUI as the default protocol (perfect for small LANs), that's protected from outside world intrusion. Add the TCP/IP protocol for connections to the Internet. Forget IPX/SPX and other protocols for now.

### Kinks, Notes, Tricks

If you're budget-minded, you can dispense with the 50 $\Omega$  termination caps (RS#278-270) and make your own. Solder one end of a 47 to 53 ohm resistor (any wattage) to the center lug of a BNC "tee." Solder the other end to the body/shell of the "tee." Figure 4 shows how.

Coaxial ethernet is good for a maximum cable length of about 170-ft, but beware the minimum length of 7-ft! Shorter lengths cause weird problems, even if the computers are side by side. Ensure the coax cable is good quality and has properly installed BNC connectors. I've had good luck with Radio Shack's RG-58 cable and "twist-on" BNC's (#278-103) but bad experience with their solderless BNC's (#278-185).

You hear talk of network security, but



don't be immediately concerned. Your LAN won't be accessible to the outside world, and internally, you have full control over what is "shared" on the LAN. For instance, you might want to network the kids' and family computers with yours, but allow limited access to yours. That's easy to set up. Computers can "see" only what you choose to "share."

### For More Information

This network primer won't make you an overnight expert, but it will get you from zero to sixty. If you need more information, I suppose you can always buy a book; there are some good ones, but technology moves so quickly that I don't recommend books for the small networker. Instead, see Table 1, and use the Web as your library. Don't be bashful about the Windows HELPs. Click START > HELP > INDEX and type "network" for a variety of things to read (and learn.)

TABLE 1: Network References

<http://www.egyptian.net/~ptadams/Networking.html>  
<http://www.buyerszone.com/network/lingo.html>  
<http://www.connectworld.net/c6.html>  
<http://www.megahertz.com/client/mcd/support/>  
<http://tampico.cso.uiuc.edu/nas/nash/>  
<http://www.sresearch.com/>  
<http://atzhim3.gordon.army.mil/css/training/LAN/>  
<http://www.pcwebopaedia.com/Ethernet.htm>  
<http://www.syntax.com/support/guest/glossary.htm>  
<http://www.lang.duke.edu/edtech/glossary.htm>  
<http://oracle.uvision.com/idx/>  
<http://www.3com.com/>  
<http://www.intel.com/network/products/network.htm>  
<http://www.linksys.com/>  
<http://netgear.baynetworks.com/>

### If You Need Help....

If you need help setting up your network, or if you just need more convincing to take the leap, contact me by e-mail, and I'll put you on the straight and narrow path.

If you can't hit my published Internet sites, go to <http://ourworld.compuserve.com/homepages/bcheek> where always posted are the current addresses for my primary Web and FTP sites. I'm happy to freely provide e-mail support for all my articles and projects. Make questions pertinent and focused and I'll always respond.

E-mail: [bcheek@san.rr.com](mailto:bcheek@san.rr.com)  
WWW: <http://204.210.11.204>  
FTP: <ftp://204.210.11.204>  
FAX: (619) 578-9247 anytime  
Postal: PO Box 262478; San Diego, CA 92196-2478

## Wireless Networks Taking Shape

Changes are underway in the nation's wireless data networks, with promises of additional services and new technologies just around the corner. This month we'll take a look at a couple of space-based communications providers and finish off with the latest auction results from the FCC.

### American Mobile Satellite Corporation

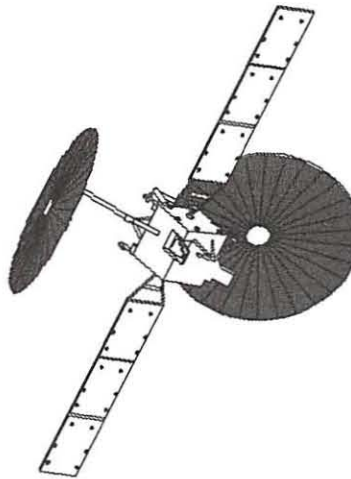
A number of changes are taking place at American Mobile Satellite Corporation (AMSC), a Virginia-based provider of mobile communications services.

AMSC launched their first satellite, AMSC-1, in 1995 to provide mobile satellite services to customers in North America. After a rocky start and some problems during on-orbit testing, they began offering telephone, data, and position reporting services to mobile customers from their geosynchronous orbital slot at 101 degrees West longitude.

After two years and more than \$600 million to build and launch their satellite network, AMSC admitted that the demand for mobile satellite services had not developed as quickly as they had hoped. In order to generate some cash flow on their underutilized satellite, late last year AMSC filed with the FCC to lease AMSC-1 (now called MSAT-2) and their ground station technology to African Continental Telecommunications, Inc. (ACTEL), a South Africa-based communications project.

Under the plan, ACTEL will move MSAT-2 to a position over sub-Saharan Africa and use it to serve mobile users and remote villages in southern Africa. A renewable five year lease will generate payments of \$38 million a year for AMSC. The Commerce Department has already approved the export of MSAT-2.

In order to continue serving their existing 29,000 or so customers, AMSC will use capacity on a satellite owned by TMI Communications and Company, L.P., a Canadian operator with whom AMSC has worked in the past. In 1996 TMI launched MSAT-1, a Hughes-built satellite almost identical to MSAT-2 with the exception of a telemetry frequency at 11,702.75 MHz. Under their agreement, AMSC and TMI will jointly own MSAT-1, each using half the spacecraft power and each retaining control of their assigned



transponders.

MSAT-1 currently sits at 106.5 degrees West longitude and provides mobile satellite services to Canada under a Canadian license. In order to allow ACTEL to test MSAT-2 prior to moving it, AMSC will transition their customers to MSAT-1 at 106.5 degrees for approximately two months. Since MSAT-1 is further west than MSAT-2, there is a possibility that AMSC customers in the eastern Caribbean will not be able to access the satellite during that time.

Once ACTEL moves MSAT-2 to a new orbital slot over Africa, AMSC and TMI will move MSAT-1 to the vacated location at 101 degrees West longitude. To conserve on-board fuel, this movement of 5.5 degrees is expected to take about a week, and AMSC proposes to operate MSAT-1 while it is in transit.

The agreements to lease MSAT-2 and share MSAT-1 are subject to a number of conditions, including the ability of ACTEL to raise at least \$120 million in financing.

AMSC will continue to offer its Skycell Satellite Telephone Service to customers in the fifty United States and the Caribbean, as well as boundary waters along the coast. Portable, briefcase-sized telephones costing anywhere from \$2,000 to \$15,000 provide a circuit-switched voice connection anywhere the user has a clear view of the satellite. A basic subscription starts at \$15 a month, with airtime fees of about \$1.50 a minute.

AMSC is currently authorized for L-band uplink (mobile terminal to spacecraft) trans-

missions at 1646.5 MHz to 1660.5 MHz and L-band downlink (spacecraft to mobile terminal) transmissions at 1545 MHz to 1559 MHz. AMSC also holds authorization from the FCC to launch AMSC-2 and AMSC-3 into orbital slots of 62 and 139 degrees West longitude; however, it is not clear if and when AMSC will exercise those authorizations.

### ARDIS

After a financial restructuring and a public bond offering, in March of this year AMSC completed the purchase of ARDIS Company, the nation's largest terrestrial two-way data network. Motorola sold their wholly-owned ARDIS packet radio network subsidiary to AMSC for \$50 million in cash and \$50 million in stock, removing a potential conflict after finding that ARDIS was competing with some of Motorola's large two-way paging customers. With the addition of ARDIS, AMSC claims more than 80,000 subscribers and service revenue of more than \$60 million per year.

As reviewed in the August 1997 column of *PCS Front Line*, ARDIS was developed by Motorola and IBM in the 1980s for use by IBM field technicians and is the oldest wireless data network currently in operation. ARDIS serves more than 56,000 mobile users via approximately 1,100 transmitters in the 800 MHz band.

RadioMail, Mail-on-the-Run, and AirMobile Wireless are three off-the-shelf products offered by ARDIS, as well as customized messaging services for business customers. A typical ARDIS application would be a field technician using a handheld modem and laptop PC to receive service assignments, repair instructions, and parts availability information over the two-way network.

AMSC has already begun to market a "dual-mode" service for long-haul transportation companies, who would use the ARDIS

TABLE 1

Some common ARDIS frequencies.

807.1375	807.4875	808.3875
810.8375	852.4875	852.9375
855.8125	855.8375	

terrestrial service while in large cities and switch to AMSC's satellite service while out on the open road.

RAM Mobile Data USA L.P., the primary competitor to ARDIS, is now fully owned by BellSouth, which bought out RAM Broadcasting Corporation earlier this year and renamed the company BellSouth Wireless Data. They plan to add 500 new base stations this year and hope to offer nationwide coverage comparable to one-way paging. Using Ericsson's Mobitex platform, BellSouth claims the network covers 93% of U.S. urban business population.

## ■ IRIDIUM

At the end of March three-quarters of the Iridium constellation satellites were in orbit. The successful launch of a Boeing Delta II rocket on March 30 added five more space vehicles to the network, bringing the orbiting total to 56. The remaining 10 are on schedule for launch as Iridium targets a commercial start date of September 23, 1998.

Iridium achieved what they proclaim as another first when the International Telecommunication Union (ITU) granted them "country status" and assigned them their own country code of +8816. Iridium subscribers will be reachable anywhere in the world they have coverage by a single telephone number with the country prefix of 8816. Of course, Inmarsat has had country codes of +870 through +874 for some time, and competing satellite systems have been assigned similar codes, such as +8810 for ICO and +8818 for GlobalStar.

Potential subscribers were given a peek at what it may cost to use the Iridium system when service begins this fall. Nippon Iridium, the Japanese operator of the Iridium service, released pricing information and will provide telephony and paging services to domestic and international subscribers. The costs of calling are somewhat complicated, since the rates depend on where the telephone is being used and what plan the subscriber is signed up for.

All subscribers will have a twelve digit number and pay a sign-up fee of about \$77, in addition to a monthly fee of \$50. Paging customers will be charged \$100 per month, or \$30 per month if they've signed up for telephone service as well.

An international plan subscriber will have a twelve-digit phone number beginning with 8816. Calls placed to an Iridium phone will cost \$6.54 per minute. The cost of calls to another Iridium phone will be based on the location of the caller, anywhere from \$6.59 in China to \$4.64 in North America. The same type of zone system applies to outgoing calls

to non-Iridium phones, anywhere from \$8.11 for calls to Africa down to \$4.52 for calls to destinations in Asia.

A domestic plan subscriber will have a twelve-digit phone number beginning with 8817, and will be restricted to use only within Japan. Calls to such a phone will cost \$2.61 per minute. A call to another Iridium subscriber will cost \$2.67 per minute. Calls from an Iridium phone to a non-Iridium phone run \$1.67 per minute.

Iridium handsets are designed to first use the terrestrial GSM network, and switch to satellite only if no local cellular network is available. While roaming on local terrestrial networks, subscribers may be charged the local rate plus \$1.07 to \$2.04 per minute for calls made to non-Iridium phones, and from \$7.73 to \$8.71 per minute for calls made to a roaming Iridium phone.

Regardless of these costs, Iridium is projecting 650,000 voice and 350,000 paging customers by the year 2000.

## ■ LMDS Auction

Yet another FCC auction has come to a close, this time for Local Multipoint Distribution Service (LMDS). As covered in the January 1998 *PCS Front Line* column, 986 licenses were on the block with two licenses available in each of the nation's 493 Basic Trading Areas (BTAs). The larger A-block license covers 1150 MHz of spectrum in three chunks: 27,500 MHz to 28,350 MHz, 29,100 MHz to 29,250 MHz, and 31,075 MHz to 31,225 MHz. The smaller B-block is 150 MHz of spectrum made up of two slices, 31,000 MHz to 31,075 MHz and 31,225 to 31,300 MHz.

TABLE 2

### Top three LMDS auction winners.

Company	A-block	Total
WNP Communications, Inc.	41.4	36.7
Nextband Communications LLC	12.1	14.6
WinStar LMDS LLC	6.7	5.9

This auction, the 17th held by the FCC, began on February 18, 1998, with 139 qualified bidders. 128 rounds later on March 25 the auction closed with 104 winners. The total amount of bids was \$578,663,029, falling far short of the \$4 billion expected for the U.S. Treasury. 379 A-block licenses covering 90% of the US population were sold along with 485 B-block licenses covering 99.5% of the population.

122 licenses were not sold and are still held by the FCC. 109 of those licenses never received a bid equal to the Commission's minimum opening bid amount and 13 licenses are

held due to bids withdrawn by participants. The FCC will reactivate these licenses at a later time, probably as soon as it figures out how to get more money out of the spectrum. For example, in the larger A-blocks, more than 40% of the markets received either the minimum bid or no bid at all.

The big winner, WNP Communications, Inc. based in Earlysville, Virginia, won a total of 40 licenses, 30 of which are in the top 50 markets. After spending \$187 million in bids they are now the largest corporate owner of spectrum in the United States. They expect their first customers to be business users, but with licenses covering 105 million people a consumer service may not be far behind. Second place winner, Nextband Communications LLC, spent \$142 million for 42 licenses covering 96 million people.

With such large blocks of frequencies, LMDS is expected to provide a variety of one- and two-way wireless services requiring significant bandwidth. Such services may include multi-channel cable television-type video programming, business video teleconferencing, remote medical diagnosis and treatment, wireless local loop voice telephone to business and small offices, and high speed connections to the Internet.

LMDS distribution systems are expected to be built out in a cell configuration, with a central transmitting hub sending high speed data to a number of fixed receivers and transceivers. Each hub would interconnect with a central processing center and other hubs. In some areas, depending on the service selections made by license holders, LMDS may become a major competitor to local telephone and cable television companies.

That's all for this month. Comments and questions are always welcome at [dan@decode.com](mailto:dan@decode.com), and more information is available at [www.decode.com](http://www.decode.com). Until next time, happy monitoring!

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E-Mail Address: [rob@sherweng.com](mailto:rob@sherweng.com)

# Treasure Trove on the Internet

The Internet is becoming a gold mine of Federal government communications information. During the last month, several of us have discovered some interesting sites on the Internet that provide much insight into federal government communications.

The first piece of information comes from Ken Windyka. Ken advises us to check out the National Telecommunications and Information Administration (NTIA) web site. Their address is: <http://www.ntia.doc.gov/>

This site provides outstanding agency specific current usage information of certain frequencies (30 to 5000 MHz) for nongovernment use. Specific links and information are provided to all military services, Department of Energy (DOE), Department of Justice (DOJ), Federal Bureau of Investigation (FBI), Federal Emergency Management Agency (FEMA), and some of the "protected" radio system areas. This site is in PDF format and will require the use of Adobe Acrobat Reader (available for free download) to read.

Ken also provided this tidbit, using the University of Massachusetts at Amherst "GOVBOT" search engine, which revealed the following U.S. Department of Justice contracts good through the year 2000:

### ELECTRONIC SURVEILLANCE EQUIPMENT

Vendor: Audio Intelligence Devices, Inc. (AID)  
Agencies Supplied: DEA, FBI, INS, USMS, ATF, and Customs

### TRACKING EQUIPMENT

Vendor: Dynatech Tactical Communications, Inc.  
Agencies Supplied: Same as above

### MINIATURE SECURE HANDHELD RADIOS

Vendor: Racal Communications, Inc. (Type: Cryptographic)  
Agencies Supplied: Government wide use



**INFRARED SENSORS**  
Vendor: Sparton Technology  
Agencies Supplied: Justice wide agencies

**INFRARED NIGHT VISION EQUIPMENT**  
Vendor: Inframetrics, Inc.  
Agencies Supplied: Same as above

**ENCRYPTED RADIO SYSTEMS**  
Vendor: Motorola  
Agencies Supplied: Same as above

### CELLULAR TELEPHONE SERVICE

Vendor: Bell Atlantic  
Agencies Supplied: Same as above

### LEASE OF LAW ENFORCEMENT AUTOMOBILES

Vendor: Ford Motor Company  
Agencies Supplied: Government wide use

A search of the web for information provided in *Commerce Business Daily* revealed that the U.S. Environmental Protection Agency Natural Vehicle and Fuel Emissions Laboratory in Ann Arbor, Michigan, is setting up a nationwide radio system.

At present, they are using 408.000 MHz simplex. Their equipment consists of 15 Motorola Radius UHF radios and one base station. Also mentioned was an unnamed radio service. This may be in the business band.

The proposed configuration consists of three new frequencies. They are: 170.375, 164.450 and 173.9125 MHz (this frequency is for alarm monitoring). The new equipment will consist of 23 mobile/portable units. Some of the units must be capable of receiving alerts automatically from the National Weather Service on 162.400/162.550 MHz. Some of the equipment must be able to be used with SCUBA gear and other radios to be used in explosive environments.

### Presidential Communications

The President has been making a lot of trips recently to continue with his "town meet-

ing" programs. Prior to the President arriving, the White House Communications Agency (WHCA) and the Secret Service advance teams will be heard setting up on the following channels:

164.8875 165.375 166.5125 167.025

All of the frequencies will be heard setting up the DVP/DES encryption systems. An additional frequency to start monitoring when the President arrives is 171.2875 (Zulu).

### Midwest Monitoring

Dale Urban (N0KQX) of Garden City, Kansas, reminds us that the summer tornado season will be upon us soon. For those of you that live in Kansas, Oklahoma, Texas, and other parts known as "Tornado Alley," the chase teams of the National Severe Storms Laboratory in Norman, Oklahoma, may be in your area looking for the severe activity. Using a variety of reporting techniques, the chase teams are coordinated by a radio network that uses 165.435 MHz as the primary frequency. This is also the repeater output frequency for the airborne repeater. The input is 163.100 MHz. This frequency is also used as a simplex channel when the repeater is not in use.

Moving a little further west, Rick Micheals sent in information that he is monitoring the frequency of 172.525 MHz. It seems this is a frequency used by an office in Idaho Falls, Idaho. The frequency is licensed to the Bonneville Power Administration and the Bureau of Reclamation of the Department of the Interior. Rick reports telephone interconnect traffic on this channel.

### Federal Action in Houston

Chris Parris reports a lot of FBI activity from the Houston, Texas, area. It seems that the FBI has set up shop for some overt operations in Houston. There is an aircraft using the callsign of SOG 20 (Special Operations Group?), with ground units SOG9, 11, and 13. Also monitored was the callsign DS 14. All of the ground units were using DES mode encryption. The aircraft remained in the clear.

A couple of additional frequencies were also monitored out there by Chris: 168.350 MHz (Hotel 2) and 173.100 MHz (Hotel 4).

The nationwide private line (PL) subaudible tone of 167.9 Hz was used on every frequency. There was also reference to an "Echo" frequency, but this was not identified. The frequency of 170.825 MHz was also used but was not given a name identifier.

Chris wondered about the airplane being in the clear, speculating whether the low frequency background "hum" of the airplane could interfere with the DES. It is known that the subaudible tones are not transmitted when using DES and/or DVP.

During the weekend Chris monitors the frequency of 168.750 MHz. This appears to be a spotter airplane flying over the Sam Houston National Forest. This frequency uses the PL tone of 110.9 Hz. The aircraft is using the callsign of 91 Foxtrot and is talking to Charlie 1, which is the U.S. Forest Service (USFS) base station. No channel name was given for this frequency, but one of the crew in 91F mentioned something about channel 17 or 19 on his USFS radio.

A frequency that is normally dead has suddenly come back to life in the Houston area. It is 411.525 MHz (carrier squelch). This is the repeater output for the U.S. Department of Agriculture Animal Plant Health Inspection Service (APHIS). The repeater is located at George Bush Intercontinental Airport. The output frequency is 415.525 MHz. The majority of the traffic seems to be involving imported plants that need inspection as they arrive from foreign countries.

### ■ Scanning out East

Coming back to the East Coast, our first stop is the **Washington, D.C.**, area. The frequency used by the security guards at the J. Edgar Hoover FBI headquarters building is 419.250 MHz. Input to this repeater is 414.150 MHz.

From the Scan-DC list, information comes in for the trunked systems in the Military District of Washington (in the District of Columbia). The VHF frequencies we all used to monitor have been vacated for the Ft. Belvoir/Department of Defense trunked system. The following are all output frequencies:

406.200	406.300	406.525
406.775	407.025	407.950
408.850	409.250	411.200

Ft. McNair, which formerly was on 143.175 MHz with a PL tone of 136.5 Hz, now is on the above system with a talk group of 93D. The old call sign for the base of "440" is still in use.

Ft. Myer, which was formerly known as "Lawman" on 142.400 MHz (PL tone 136.5 Hz) and 142.975 MHz (PL tone 136.5 Hz) is now assigned on talkgroups of 92E for post operations and 93F for ceremonial support.

The military police at Ft. Belvoir have been up on the trunked system for several years using the talk group of 7D9. Thanks to Bill Hardman for this information.

Ed Lynch in the **Chesapeake Bay** area reports a lot of activity on 167.6375 and 173.7375 MHz recently. Some traffic, although to a much lesser degree, has shown up on 165.4375 MHz. All communications have been encrypted by DES.

Information comes in from my old stomping grounds in **Sevierville, Tennessee**, not too far from the "MT Complex." This is next to the entrance to one of the most beautiful national parks in the country, the Great Smoky Mountains. The Federal Highway Administration has operated a repeater system there for many years. The output is 166.025 and the input 165.2625 MHz running carrier squelch (no PL tone). Now it seems this system has gone silent. Can anyone provide any information on this system?

### ■ Trash or Treasure ?

From a government auction in the southern California area came information from a source who wishes to remain anonymous. He went to the auction and purchased for literally pennies on the dollar several radios which came from federal service in Nevada. These radios still had their code plugs in them. By reading the code plugs, he was able to provide the following information for some of the federal agencies in Nevada.

#### Internal Revenue Service (IRS)

408.400	409.875	416.800
418.075	418.175	418.225
418.200	418.625	418.675
418.750	418.825	418.850
418.900	418.925	440.000

#### Drug Enforcement Administration (DEA)

412.000	412.125	413.000
414.025	414.050	414.150
414.350	414.450	414.475
414.500	414.550	418.950
418.975	419.500	

#### U.S. Customs Service

154.650	154.6800	154.7400
154.7700	154.8900	154.9200
155.475	155.5050	

(Federal agencies allowed federal agents to use these public safety frequencies for inter-agency communications with local law en-

forcement and are not allocated to the Customs Service on a primary basis)

162.0500	163.1250	163.6250
164.5500	164.8625	165.2375
165.4375	165.5875	165.7375
165.7625	166.4625	166.5875
	169.4500	

Our provider did not specify which frequencies were input and which were output frequencies — you will have to do some of the work yourself.

Note the frequency of 440.000 MHz in the IRS radios. I doubt if this is a typo. It has been long known that government agencies once in a while use amateur and/or commercial frequencies. I remember the time that DEA set up shop in south Florida using two repeaters in the 440 MHz amateur band. It never hurts to put those scanners in the "search" mode or better yet, go find a spectrum analyzer and see for yourself what is out there.

### ■ More "Surplus"

I was down at the Miami Hamfest this year. This is another way to find "surplus" government radios. One surplus seller had a complete Audio Intelligence Devices (AID) "Birdog" tracking system for sale. When I was using this system, it was selling for close to ten thousand dollars for a complete system. He was selling it for a measly fifteen hundred dollars!

It had two tracking transmitters, marked with the frequencies 165.9125 and 166.4625 MHz. It also had a sign saying Alcohol, Tobacco, and Firearms (ATF) on the outside. Was this surplus property? Did it fall out of an ATF vehicle? I wonder what improved toys they now have.

The "Birdog" unit produces a pulsed transmission on the frequency listed: There is no modulation. The receiver uses two antennas on the roof of the car. Some of the new units have four antennas.

Today there are much better, and cheaper, units than this AID unit on the market. Perhaps that's why there are a lot of the AID products showing up on the surplus market. Last year at the Orlando Hamfest I purchased a complete AID body bug repeater system, which consisted of two one-watt body bugs, two pocket receivers, and a portable battery powered repeater. Again, the price of these components as a system would approach 8-10 thousand dollars from AID. I paid a hundred dollars for it. And it works.

73's..John..WA4VPY (now an *Advanced* Class amateur ... after only 33 years as a Technician!)

# Equipment at the ATC Center

Welcome to the Air Traffic Control Center for a look at the tools of their trade. Centers have a similar operational setup to terminals, but on a much larger scale. They have numerous phone lines connecting them to facilities, sectors, and centers in their area and adjacent areas, as well as to the Traffic Management Unit or "Flow Control" in Washington, D.C. The individual control position has every phone line needed, and radios for communication on the VHF band and UHF band.

Some centers have added a traffic position controller to monitor and assist the radar controller with any necessary coordination. This controller also monitors the traffic situation for potential conflicts. The position has telephone and radio capability. In busy periods, a sector may have a third controller to assist with flight data.

The center automation system is slightly different from the tracon's system when it comes to radar data processing. The computer transforms the primary radar return into a digital signal for display on the controller's scope. Consequently, the scope can be adjusted to display only those aircraft known to be in the altitude levels controlled by the sector and those whose altitude is unknown. This clears clutter off the screen.

The controller's radar scope displays a data block connected to the radar target, which indicates aircraft identification and altitude. The controller operates a computer input device as well as a trackball. A small screen located to the side of the scope displays information, such as weather at specific airports and beacon codes that can be assigned to an aircraft.

The equipment providing controllers with the information necessary to track and communicate with aircraft are likely to be located at facilities many miles from the center itself. Remote communication air-to-ground (RCAG) facilities use microwave links to get the signal to the controllers.

Center radar equipment has a 200-mile radius and an antenna rotation cycle of 10-12 seconds. Today, most centers have access to two or more radars covering much of the same airspace. The computer takes the best presentation from the available sources and displays it on the controller's scope. These technological advances enable center controllers to routinely "see" and control aircraft flying through the air hundreds of miles from the center building.

Strip printers and strip bays are sprinkled liberally throughout center facilities. Charts placed above each position show specific areas of responsibility.

Each center has a meteorologist on duty to inform controllers about significant weather in their area. Facilities also have their own traffic management unit, which coordinates with the Washington, D.C. facility to ensure the optimum flow of traffic into sectors.

Centers may have an impressive array of lights, buzzers, voice calls, scopes, telephones, strip bays, and teletypes. However, keep in mind, the key ingredient is the human one, the controller him or her self. A partner in an adjacent sector will help a fellow controller in a bind, or a supervisor will get someone to share the workload and will impose restrictions to help moderate the number of aircraft coming into an overloaded controller's airspace. These are some of the *human* tools in a very stressful trade.



Overlooking Atlanta ATCC (photo by Harry Baughn)

to the archives, but primary routes have proliferated to such an extent that today, ninety percent of the eastern half of the United States is controlled airspace. It is only in such areas as Nevada, New Mexico, and Arizona that pilots can find any large areas of uncontrolled airspace.

"Air traffic control clearances are effective only in controlled airspace. Other airspace is considered 'uncontrolled.' Aircraft can also fly in uncontrolled airspace without contacting a controller. In such a situation, the

pilot is essentially on his own, with the exception of the federal aviation regulation that specifies altitudes to be flown, providing some separation from crossing and opposing aircraft."

- Byron Oring (NY) reminds us that "all aircraft flying a 'J' (Jet) route (over 18,000 ft.) set their altimeters to a barometric pressure of 29.92, so that if there is an error in setting accuracy, all aircraft over 18,000 feet (instrument flight rules - IFR) have that same slight error, meaning there is less chance of collision. If the real barometer pressure is slightly different, an aircraft at flight level 330 could actually be over or under 33 thousand feet — but since everyone else has that same error, it's no problem."

Brian also included frequencies for airports in his area:

**JFK:** Tower - 119.100, 123.9; ATIS\* - 128.725, 117.700, 115.400, 115.100; Approach - 127.400, 134.350, 132.400, 120.800, 123.700; Departure - 135.900, 134.350, 124.750, 123.700.

**LaGuardia:** Tower - 118.700; ATIS\* - 127.050; Approach - 120.800, 132.700, 128.800 (final), 124.950, 118.000. Departure - 120.400, 124.450.

**Westchester County Airport** (White Plains, NY): Tower - 119.700; ATIS\* - 116.600, 133.800; Approach - 126.400, 124.650; Departure - 120.550.

\* ATIS - Automatic Terminal Information Service

### Readers' Corner

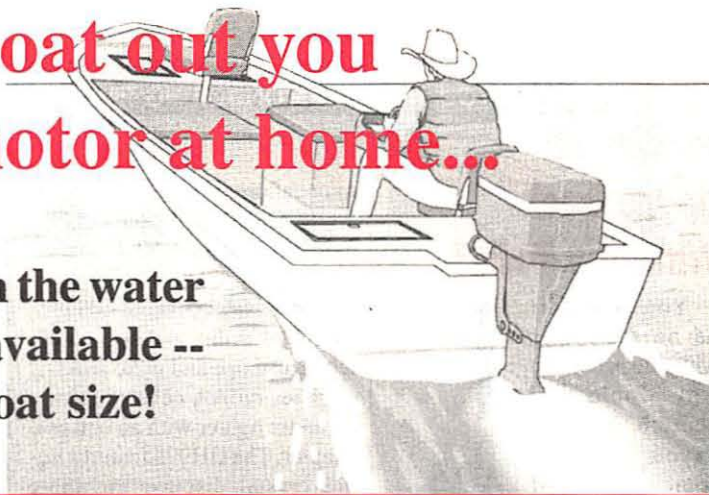
- From Alan Fox (WA) comes this information about controlled airspace:

"In the United States, the term 'controlled airspace' has a specific meaning. It simply means that controllers can issue an air traffic control clearance for the airspace and that planes flying under instrument flight rules in the airspace must have a clearance. Planes flying under visual flight rules can fly in some controlled airspace without a clearance. However, they must observe the provisions of the regulations that specify safe operation of their aircraft. This is not the case in many other countries, which do not have as many pilots who want to fly visually.

"Originally, controlled airspace was confined to the airways and the airspace needed for pilots to depart the airport and get to the airway. Then the system created the alternate airway. It was a route that diverged from the main airway then rejoined it at the next navigational aid. The airspace between these airways became controlled airspace.

"Alternate airways have now been relegated

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Whether you're out in the brush or in a strange city, the GPS III is constantly vigilant, providing you with an accurate digital compass for bearings, telling you where you are, where you've been, and where you're going, with a computed accuracy within a few feet!

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munications using its full 5 watts. An FCC license is no longer required to operate VHF marine radio.

The HH995 puts out 600 milliwatts of audio, and also comes with earphone and mike jacks. It operates on AA cells or from a cigarette lighter with an optional adapter. The HH995 features liquid crystal display, nighttime backlighting, memory scan, and comes with AC adaptor/charger, rubber antenna, belt clip, wrist strap, and manual.

It was probably just such a radio that saved the lives of the crew of the *Vanessa* (see *Communications*). Reasonably priced at \$179.95 from Grove Enterprises (800-438-8155, or [www.grove-ent.com](http://www.grove-ent.com)), the compact, light-weight HH995 could be the best investment you ever made!

## When You're Completely at Sea...



For long range cruising sailboats, boating along the coastline, mounted in the plane, or going mobile in your vehicle or camper, a low-power, low-cost solution to long-distance operation is the SGC SG-2020. The shortwave, single sideband transceiver can be used as an emergency back-up to your primary radiotelephone or as a way to enjoy amateur radio almost any-

where without lugging along a lot of gear. This unit is both small and tough.

Frequency coverage is 1.8 to 29.7 MHz, with up to 20 watts PEP transmitter power; it features 40 simplex or semi-duplex memories, iambic keyer, and may be operated from a power pack or a "D" cell flashlight battery pack (optional). The SG-2020 retails for only \$625. A portable version, complete with battery pack, mike case, and shoulder strap (SG-PortaPak) retails for \$1195.

Contact SGC at 800-259-7331 or visit their website at [www.sgcworld.com](http://www.sgcworld.com) for more information on this new multi-mission transceiver.

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The GPS 12 Outdoorsman's Companion sports water-tight, rugged construction and high sensitivity to lock onto the satellites even through rain or foliage. The GPS 12 can give you 500 waypoints to your selected target, 20 reversible routes, local area features, and even custom mapping. It will even accept DGPS correction for improved accuracy over its advertised accuracy of 3 feet. The GPS-12 is priced at \$159.95 from Grove.



The GPS III can take you anywhere in North America with its built-in road map. Simply point the electronic cursor to a location in NA and zoom in. Along your way the GPS III records your waypoints and provides comments with text and icons, including a trip odometer with your speed. The display is readable in any lighting. Priced at \$379.95, the 9-ounce GPS III includes wrist strap, Velcro mount, quick reference



card and user's manual.

Top of the line is the Garmin StreetPilot at \$549.95. This sensitive receiver includes all the features of the GPS III and includes ports for DGPS correction, records up to 100 waypoints, and 20 reversible routes. An optional data card (each city purchased separately) can guide you along a comprehensive street map to your destination. The data even includes business names, addresses, and phone numbers for the chosen area.

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To learn more about Globe Wireless and their services, visit [www.globewireless.com](http://www.globewireless.com) or contact their offices in Foster City, CA, at 605-372-2650.

## RadioScience Observing

MT readers as well as generations of hams will recognize the respected name of author Joseph J. Carr, who has contributed so much to the field of hobby radio. His latest work emphasizes several fields which have growing interest, including radio astronomy, whistlers and spherics, VLF and propagation, solar eclipse effects, sudden ionospheric disturbances (SIDs), and meteor and solar flare detection.

The book includes an interesting CD-ROM of WAV files for the listener to learn to identify the sounds he is likely to hear during his research in this fascinating part of the spectrum.

Numerous chapters detail construction of antennas, detectors, amplifiers, receivers, and other



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*RadioScience Observing* is \$29.95 from Prompt Publications (Howard W. Sams), order toll-free by calling (800) 428-7267.

## Florida Scanning Guides

Two handy, new scanner guides for Florida listening hobbyists will make the job a little easier. The

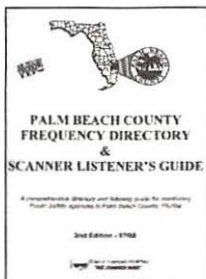
*South Florida Trunking Guide* lists trunking system frequencies for six southeast Florida counties from Indian River through Dade County, along with IDs and operating tips of help when using the new Uniden (and private-labeled Radio Shack) Trunk Tracker radios.

The *Palm Beach County Frequency Directory and Scanner Listener's Guide* is a handy reference for that highly-populated area, and includes business, fast foods, broadcasting, public safety, federal agencies, amateur radio repeaters, aviation, and more. Listings are cross-referenced by frequency and agency. A comprehensive glossary of public safety radio terminology is included to aid the listener.

Both books are by Brian Cathcart, KE4PMJ ("The Scanner Dude"). Cost for either booklet is \$9.95 including shipping, or both for only \$17.95. Order from the author at 4050 Edgewood Drive, Coconut Creek, FL 33066-1835, [ScannerDude@juno.com](mailto:ScannerDude@juno.com).

## Shortwave Receivers Past and Present

Well over 700 communications receivers from nearly 100 manufacturers worldwide adorn *Shortwave Receivers Past and Present*, a glossy photoessay by



Fred Osterman, now in its third edition. Shortwave listening products made from 1936 through the present take the reader from revered names like Hallicrafters, National, Hammarlund, Collins, Gonset, and Drake through newer entries like JRC, Sony, Watkins, Johnson, Yaesu, Kenwood, ICOM, and AOR. And in the very back, a section called

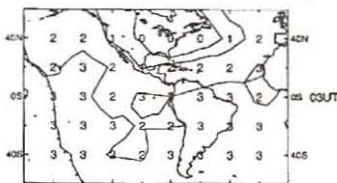
"Receivers That Never Were" even shows the formerly proposed Grove SW100 and SR1000!

Alphabetized by manufacturer, the photo-illustrated listings include basic specifications, years of manufacture, description, original pricing, and current market value. An introductory glossary explains features and controls, and lists sources for parts, repair, and information.

*Shortwave Receivers Past and Present* is \$24.95 plus shipping from Grove Enterprises (800-438-8155) and other MT advertisers.

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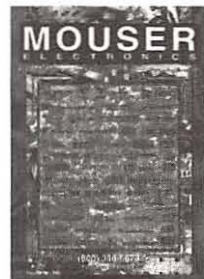


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# Optoelectronics Optotrakker

By Haskell Moore, KB5WIX,

Email: kb5wix@aol.com

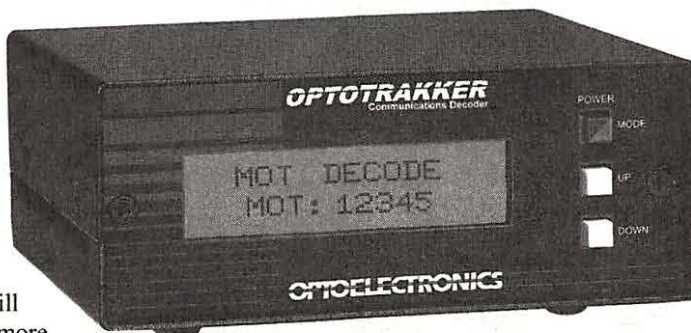
**F**or years, the ability to monitor trunked radio systems eluded the average hobbyist. It wasn't until the Uniden introduced the TrunkTracker in 1997 that interest in trunked system monitoring really took off. And now, a new and innovative hardware/software combination has just been introduced that will make trunked monitoring even more exciting.

The **Optotrakker** from Optoelectronics, along with a newly introduced version of ScanStar for Windows, promises to add a whole new dimension to trunked monitoring. First, let's take a look at the Optotrakker hardware.

The Optotrakker is an essentially an Optoelectronics DC442 all mode decoder (see p86 for DC442 review) with substantial enhancements inside and out. In addition to the trunk decoding functionality, the Optotrakker can decode and display 50 subaudible continuous tone controlled squelch system (CTCSS) tones, digital coded squelch (DCS), and DTMF (touch tone) codes. It also incorporates two Icom CI-V ports, two RS-232C ports, a transistor-transistor logic (TTL) port, a "data slicer" and a flexible flat cable connection for the AOR AR8000.

In addition to the decode modes mentioned above, it now has the ability to decode both logic trunking radio (LTR) and Motorola trunking information. And what makes the Optotrakker so unique is that it performs the trunking data decoding without the use of the control channel. The significance of this will be discussed when we explore the software.

Operation of the Optotrakker is relatively simple and straightforward. One button doubles as a power switch and mode selector. The modes of operation include CTCSS, DCS, DTMF, DTMF Recall (up to 1023 scrollable characters), LTR, and Motorola Decode. Another enhancement is the built-in calendar and 24-hour clock. All of this is displayed on a clear, two-line, lighted electroluminescent display that is



large enough to be seen from several feet away.

The Optotrakker also has a wide range of configuration options. The trunk identification can be displayed in hexadecimal or decimal (to match the TrunkTracker). The display light, baud rate, CI-V address, and numerous other parameters are easily programmed with just three buttons.

For those who like to use a laptop for their computer controlled scanner, you'll be pleased to know that the Optotrakker can do so with just one serial port. And what's even more impressive is that by using what Optoelectronics refers to as "pass-through" technology, this one serial port can still be used for other functions as well!

In other words, the computer's serial port connects to the Optotrakker, and by using a supplied cable, a serial device can be connected to the other side of the Optotrakker. The Optotrakker and the software work in concert to strip out all of the Optotrakker commands in both directions. It is then essentially invisible to the serial port, and does not affect operation of the device, such as a modem, which shares the port.

## ■ Software enables mixed system scanning!

The second component of this system is the "ScanStar For Windows" software from Signal Intelligence. This much-improved version of ScanStar has been modified to work in conjunction with the Optotrakker to allow computer controlled trunked scanning with a variety of radios, including the previously unsupported Icoms.

Since the Optotrakker does not require a control channel to accomplish its trunk tracking, only one radio is required. This also allows the ScanStar software to not only follow a specific trunk, but mix several trunks (both LTR and Motorola) and conventional frequencies simultaneously. Finally, you'll be able to use just one computer-controlled scanner and one serial port to track all the action!

When following trunked communications, you can configure the software to work in either the "closed" or "open" mode, which is analogous to the Uniden TrunkTracker's "scan" and "search" modes. In the "closed mode," only those talk groups you've specified will be heard. In the "open mode" all talk groups are heard except those you specifically exclude. This is especially useful for finding new talk groups on your local trunk.

For the Optotrakker to decode correctly, it requires a signal directly from the discriminator of the radio; speaker or ear jack audio will not work. The discriminator provides the cleanest audio before it is subjected to the filtering and is not affected by the volume control. For those who are reluctant to perform modifications on their scanner to get the discriminator audio, Optoelectronics will provide a list of sources where you can ship your radio and have a discriminator tap installed for a relatively modest charge.

The radios supported by the Optotrakker/ScanStar combination include: Icom R7000, R7100, R8500, R9000, R10, AOR AR8000, AR5000 as well as the the Radio Shack PRO-2035, PRO-2042 and PRO-2006 when using with the Optoelectronics OS535 or OS456 computer interface. Upgrades to the Optotrakker can be easily performed by replacing a plug-in chip.

The Optotrakker is being offered at an introductory price of \$299 and is available from Optoelectronics, 5821 NE 14<sup>th</sup> Avenue, Ft. Lauderdale, FL 33334 (800-327-5912 or 954-771-2050).

## Opto DC442 Communications Decoder

Okay, so you have a high end scanner with built-in programmable CTCSS/DCS squelch. How do you know which code to program? The Uniden BC895XLT has a tone search, but it's slow. If you have another model, you could program the same frequency and a different code into each memory channel and see on which one the scanner stops. That's a lot of work!

The quickest way to determine what CTCSS or DCS code is being transmitted is to use a code display device. I've used a Connect Systems CD-1 for years. It has a large, bright red LED display which shows CTCSS, DCS, and DTMF signals. The CD-1 is no longer made and has been replaced by the CD-2, a new model enhanced with computer logging capability. It lists for about \$200. For more information, contact Connect Systems Inc. (Ventura, CA; 800-545-1349; <http://www.connectsystems.com>).

On a different installation, I display CTCSS frequencies using an old Helper Instruments "Toner," which effectively multiplies the low frequency CTCSS signals by 100 so they can be displayed by a Fluke universal frequency counter. Helper Instruments is still in business but no longer sells the old Toner I use. For a catalog of interesting communications test equipment, contact Helper Instruments Co. (131 Tomahawk Dr., Indian Harbour Beach, FL 32937; 800-327-9308).

### ■ Optoelectronics DC442

I borrowed the newest code display marketed to hobbyists, an Optoelectronics DC442 Communications Decoder. Once connected to a scanner or wide spectrum receiver, the DC442 can display three signaling characteristics:

- 52 different CTCSS (Continuous Tone Controlled Squelch System) tone frequencies,
- 106 different DCS (Digitally Coded Squelch) codes, and
- 16 DTMF (Dual Tone Multi Frequency) digits and characters

The DC442 requires an operating voltage of 7 - 15 VDC, 400 mA. It can be powered by the supplied 120 VAC "wall wart" adaptor or from an optional, internal NiCd battery pack. The DC442 has a front panel power switch, which serves another purpose during configuration. (You cannot take something as basic as



FIGURE 1: Optoelectronics DC442 Decoder.

a power switch for granted. It's difficult to believe, but the CSI CD1 has no power switch, so I installed one by drilling a hole in the back panel and mounting a small toggle switch.)

The DC442 rear panel is fitted with a 2.1 mm DC power jack and three 3.5 mm stereo phone jacks (figure 2). The mating 3-conductor phone plugs are not supplied but should be. The first stereo jack is used to carry audio from your scanner and, optionally, a squelch logic signal. The second stereo jack is for connection of other CI-V devices, and the third jack is an RS-232 serial data port.

You can connect the DC442 to the external speaker jack of a scanner, but it would be better to connect it to a baseband audio tap within your receiver. That would bypass audio filtering stages which normally attenuate the low frequency CTCSS and DCS signals transmitted below the frequency range of most human ears.

The DC442 booklet shows how to tap baseband audio in the Radio Shack PRO-2006, ICOM R100, R7000, and R7100. I use the DC442 with an ICOM IC-R8500 and Bearcat BC9000XLT. The ICOM R8500 came factory equipped with a baseband audio jack and I added a jack to the BC9000XLT (see June 1996 MT).

The optional squelch input connection permits the DC442 to display the squelch status. You can synchronize the backlight to a signal, for example. The DC442 expects 2 - 12 VDC when a signal is present and 0 - 0.5 VDC when it's not. You can reverse this through the configuration menu.

If you don't want to make an internal connection to the squelch circuitry, you may be able to improvise by using a battery in series with the tape recorder control jack, as found in the ICOM IC-R8500, BC9000XLT, etc. The DC442 squelch input provides an input impedance higher than 5,000 ohms, so it draws less than 3 mA.

The DC442 employs a 2 line by 16 character super twist LCD module. It's a dot matrix, alphanumeric arrangement. The display is illuminated by a green/blue EL (electroluminescent) backlight. The backlight in our DC442 was too bright and the actual display contrast rather low. The display can be turned on or off manually or controlled by the squelch line.

There are several modes and configuration options. Front panel pushbuttons are used to navigate and select choices from the menus. You can force the DC442 into single mode operation to display only DTMF, CTCSS, or DCS. More often, we used the "All Decode" mode which allows the DC442 to display whatever code it detects. Normally, the display shows the last 10 DTMF digits detected. An internal memory remembers a total of 1023 digits, which you view 16 at a time, in "DTMF Recall" mode.

DCS and squelch polarity are also selectable via menus. We didn't connect our DC442 to a PC, though the manual mentions an "ASCII Dump" mode, which "allows for remote display on a PC using a terminal emulator program." There was no further explanation nor pinout diagram for the DB9 serial connector found on most PCs. You would need to purchase an optional \$40 cable from Optoelectronics or make your own.

The DC442 works reliably in actual use. It is difficult to discern whether it is any faster or slower than my old CSI CD1. The CD1 and DC442 cabinets are about the same size, but the CD1's large red display is much easier to read, especially at a distance. Viewing the DC442 display from an angle is difficult.

The CD1 usually blanks when no signal is being received, so you must look at it during the transmission to determine the code. The DC442 remembers the last code detected. In my temporary setup, the DC442 displays a CTCSS or DCS code, followed by an asterisk during transmissions. Because I do not use the DC442's squelch input, the asterisk disap-

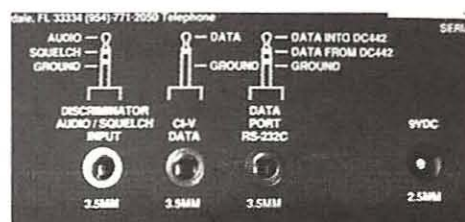


FIGURE 2: DC442 rear panel jacks

Model	Manufacturer	#Channels	#Banks	#Scan Speeds	Display	Auto Squelch	WX	Air Band
BC210	Electra	10	1	1	LED			
BC210XL	Electra	18	1	2	fluorescent	y		
BC210XW	Uniden	20	1	2	fluorescent	y	y	
BC210XLT	Uniden	40	2	2	fluorescent	y	y	y

pears after the transmission ends, though the code remains on display. The asterisk is difficult to see and a separate, bright "signal detected" LED would be an improvement.

Summarizing, the "high tech" DC442 decodes well and has lots of features. The low contrast EL display is its main drawback. The manual is fairly good, but needs a fuller explanation of the ASCII Dump and CI-V facilities. (See the late-breaking product announcement on page 85—Opto has now revealed one intended use for these connections!—ed.)

#### ■ Plectron Receiver Notes

The January 1996 column was devoted to Plectron and Motorola Alert Monitor receivers — the most popular receivers used by firefighters in the 1970s and 80s. That column prompted a steady stream of mail from readers who either owned these radios or were interested in acquiring some. Dan McNulty writes that his Plectron collection now numbers 37 and asks about obtaining crystals.

My favorite source for Plectron and Motorola Alert Monitor crystals is International Crystal Mfg. Co., 11 N. Lee Ave., Oklahoma City, OK 73102. Telephone 405-236-3741 and 800-725-1426. International can make the proper crystal if you supply them with the exact receiver model number, printed on the rear label of your receiver.

Repair service and replacement parts for the Plectron P1 and R700 models is offered by: Weber Electronics, PO Box 212, 5138 Laurel Ln., Broad Run, VA 20137; telephone (540) 347-7760; email: [weber@citizen.infi.net](mailto:weber@citizen.infi.net)

You can also obtain Plectron repairs and parts from: Northeast Communications, 4 Oak Ridge Rd., Newfoundland NJ 07435; telephone (201) 697-8804.

Replacement AC power cords for the Plectron R700 series receivers are scarce. Figure 3 shows the pinout for the chassis mounted power connector, as viewed while standing in back of the radio. I often install a new AC line cord by soldering the ends to the connector pins inside the radio. That requires drilling a hole through the aluminum rear panel and using an anti-chafe rubber grommet. If you solder a new cord to this connector,

make sure you insulate the connections to prevent an electrical shock hazard.

You can order a replacement Alert Monitor power cord from Motorola or hard wire a new AC line cord as I do. Figure 4 is a wiring diagram for the Motorola Alert Monitor chassis mounted power connector. Installing an AC line cord requires a bit more work than in the Plectron. I break out Motorola's plastic

connector and drill out the rivets which held it in place. I replace the original power connector with a small metal plate, bolted to the chassis through the old rivet holes. I drill a hole through the plate, install a grommet in the hole, then feed a new line cord through the grommet and solder the wires.

#### ■ The BC210 Family

Mike Dumford, K6MKD, asks "What are the differences between the four models of the Bearcat 210, 210XL (which I have), the 210XW, and the Uniden-built 210XLT?"

The BC210 was Electra's first keyboard programmable scanner with a numeric frequency display. Electra and then Uniden stayed with the "210" designation through four models. The high points are summarized in the table above.

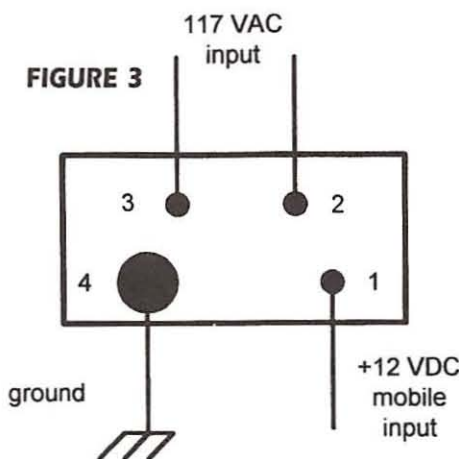


FIGURE 3  
Plectron chassis mount power connector pinout

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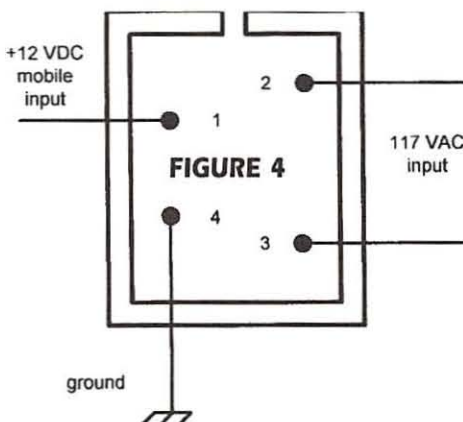


FIGURE 4  
Motorola Alert Monitor chassis mount power connector pinout

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For hamfests in your area, visit <http://www.arrl.org/hamfests.html> or call the ARRL at 860-594-0200.

## Drake's R8B: Is it *Der Titan*?—Part II

Last month, we began to lay out our findings on the Drake R8B, the best-selling shortwave tabletop receiver in the world. Now, here's the rest of the story!

### ■ Four voice bandwidths plus CW

The R8B comes with four voice bandwidths—6.0, 4.0, 2.3 and 1.8 kHz—plus one CW (Morse code) bandwidth. This continues the commendable Drake tradition of not offering unneeded super-wide bandwidths, the way some other manufacturers do. As with the R8 and R8A, these use cost-effective high-Q LC circuitry, and thus additional or substitute bandwidths can't be installed. These bandwidths have decent but uninspiring performance, with acceptable shape factors and excellent ultimate rejection. None begins to compare with, say, the razor-sharp selectivity of the Watkins-Johnson HF-1000 professional-grade supersets.

The earlier Drake R7 series, as detailed last month, used eight-pole crystal-lattice filters with commendable performance characteristics, and these could be added or removed by a skilled technician pretty much at will. Consequently, shortwave broadcast listeners and DXers uninterested in CW tended to equip the R7 with five bandwidths, then and now available from Sherwood Engineering and to some extent Drake: 6.0 kHz, 4.0 kHz, 3.0 kHz, 2.3 kHz and 1.8 or 1.7 kHz (with the R7A and R4245, this required disabling a CW audio filter from the most-clockwise bandwidth setting).

Nearly all these five-voice-bandwidth—as well as four-voice-plus-one-CW-bandwidth—conversion receivers were sold new by Gilfer Shortwave, back when the late industry leader Perry Ferrell was at Gilfer's helm. They can be identified by their matching front-panel overlay showing the new filter bandwidths and their respective switch positions. These are among the great gems of the used-receiver market.

Thus, an R7 configured with five voice filters has better and more flexible selectivity than the R8B.



### ■ Excellent synchronous detection for selectable and double sideband

The R8B is equipped with selectable-sideband synchronous detection, which is the same circuit used in the current version of the Drake SW8. It's a vast improvement over that found in the R8A, which was a mess. The original R8 had better sync lock than did the R8A, but even then the R8B is not only better yet, but it is superior by any yardstick. Here, Drake's engineers really did their homework, even allowing the sync to work not only in LSB and USB, but also with the receiver's excellent passband offset control and in double-sideband.

Of course, the R7 didn't even have synchronous detection. Back when it was introduced in 1979, it was an engineering dream as yet unattained on any receiver. However, the R7 can now be equipped with the Sherwood Engineering (303/722-2257) SE-3 Mark IV accessory and IF converter, which provide the R7 with synchronous selectable—or double—sideband and outstanding audio quality that are even better than on the R8B.

### ■ Audio quality better for music than DX speech

Audio quality? For listening to music, the R8B is quite pleasant—listeners often describe it as "mellow." Overall distortion measures quite low in *Passport's* lab, and there's a high-cut tone control, as well as passband offset, to help soothe the ears. The internal speaker is surprisingly competent, as well.

Withal, for sheer intelligibility the audio on the R7 is noticeably crisper for DXing. Add the Sherwood SE-3 accessory, and the

R7 becomes tops for listening to music, as well. However, the R7's greater intelligibility is partly a function of age and gender. A young woman's ears, for example, will have little trouble with the R8B's "mellow" audio, whereas older baby-boomer males are more likely to be bothered by the R8B's relative lack of crispness.

The R8B has slow and fast decay constants which are user-selectable, along with AGC "off." Overall AGC performance is excellent. The R7 has slow, medium and fast decay times, plus "off," but the R8B's exceptional AGC performance fully compensates for its lack of a medium decay choice.

The R8B has no RIT (receiver incremental tuning) control, nor with its precise tuning does it need one for reception-only applications. Considering the ubiquity of mute buttons—on TV remote controls, PC operating systems, RealAudio and the like—it is surprising that the R8B has no mute control, although you can jury-rig an outboard muting system via a rear-panel port.

The R7 has a marginally useful RIT which also adjusts the frequency display, as well as a mute button located on the front panel, where it belongs.

### ■ Much-improved ergonomics

The R8B's ergonomics are improved over earlier versions in the R8 series. For example, a single button selects each of the five bandwidths, plus there's an AUTO button that automatically selects the bandwidth for you. There is also a button for each of the operating modes. Some software logic could be improved slightly, and there's no substitute for discrete controls in lieu of a function key. But overall, the R8B acquits itself well in the ergonomics department.

The R7's tuning is clunky and woefully out-of-date. Yes, the R7 relies on lots of discrete, well-spaced controls to accomplish tasks, and its front-panel layout is sensible and intuitive. But that's not enough to alter the verdict: The R8B wins the ergonomic arm-wrestling contest against the R7, hands down.

## ■ High rating in lab tests, although R7 slightly better

In *Passport's* lab tests, the R8B earns high ratings in nearly every measurement of receiver performance, even taking into account minor "birdies" just above most X.5 MHz points (5502 kHz, 6502 kHz, 7502 kHz, etc.). This receiver, unlike many others, has been designed as it should be—to perform well all-around, and not just to excel in a limited number respects. However, except for frequency stability, which on the R7 gets a "D" minus, the R7's lab results are pretty consistently ahead of those for the R8B, and you can hear the difference.

For example, the best test of the ability of a receiver to bring out weak signals is the noise-floor measurement. In our lab, the R7 outperformed the R8B in this regard, as well as in the related blocking measurement, which measures the degree to which a receiver is desensitized by a nearby powerful signal. This is audible when, using the same bandwidths, the R8B is put head-to-head against the R7 with weak signals, especially in the higher reaches of the shortwave spectrum. The R7 consistently pulls out more feeble-signal DX, and the R7 is not the all-time champ in this regard.

On mediumwave, the R8B's sensitivity is virtually identical to what it is within the shortwave spectrum, and it's only a touch less on longwave. Ditto the R7, provided you adjust a pot within the receiver for maximum mediumwave sensitivity.

## ■ Verdict: Best among new receivers in price class

Bottom line is that the Drake R8B is the best choice among new receivers in or below its price class. Indeed, except for genuinely serious DXing it is largely competitive with receivers costing considerably more.

It is a nicely rounded receiver, with nearly everything done right. And if anything goes wrong, Drake's service is without equal. The R8B isn't enough to get me to put my R7 out to pasture, but because of the R7's lack of sophisticated tuning controls it is not one of

our primary receivers for ascertaining schedules for *Passport to World Band Radio*. However, for personal use the R7 with the Sherwood SE-3 is still my favorite receiver.

The R8B also isn't enough to get *Passport's* editor Tony Jones to switch from his Japan Radio NRD-515, contributing editor Jock Elliott to drop his love affair with the AOR AR7030, or colleague George Zeller to part with his Watkins-Johnson HF-1000 "DX Machine." But even if someone were to give you a free stock R7, it would cost as much as an R8B just to have the R7 equipped with the full complement of voice bandwidth filters and SE-III accessory from Sherwood. As to the HF-1000, it costs over three times more than the R8B!

So it is little wonder that Drake's factory in Ohio is barely able to keep up with orders for the R8B. It and the quasi-portable Drake SW8 are the best offerings in their respective price classes, and there appears to be nothing forthcoming that should change that situation anytime soon.

## Used Receiver Book in Third Edition

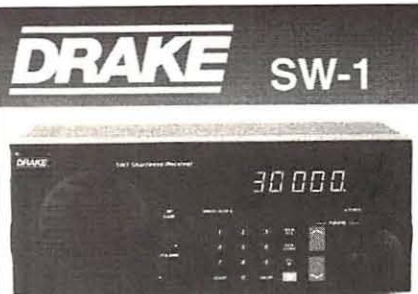
Fred Osterman's compilation of tabletop communications receivers made since 1942 is now in its third and best-ever edition. Just as any collector of Beanie Babies first consults with the book on Beanie Baby collectibles before making an investment, so anybody interested in vintage receivers absolutely, positively needs to have the latest edition of this 473-page, large-format tome before beginning to haggle.

*Shortwave Receivers Past & Present* is stuffed with information on price, factory specifications, photos and scarcity for 770-odd tabletop communications receivers from around the world. It sells for \$26.95, including domestic shipping, from Universal Radio Research (800/431-3939).

If you have any interest in older tabletop communications receivers, or are just intrigued by the idea of owning one of the great "boat anchors" of yesteryear—or something like the Drake R7 discussed in this column—get this book!



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# Tour de Spectrum — Computers & Radio Goes to Paris

**D**uring a recent trip I took to Paris, France, I had a look at what the French have in the way of computers and radios. *Ooh la la*, was I surprised!

It's been almost twenty years since I first went to the beautiful city of Paris. Since that first visit a lot has changed. But most of the changes have taken place in the past five years. The Eiffel tower, which some Parisians call the oil derrick on the Seine, has always been used as a mediumwave and shortwave antenna tower.

Mr. Eiffel was a mechanical engineer who designed and oversaw the construction of the tower. When it was completed he maintained an apartment on the tower and entertained luminaries of the day such as Edison and Marconi. During the early part of the 1900's a mediumwave station broadcast from the Eiffel tower and was heard all over Europe during the day. Reception of the station in Canada was reported on many evenings. Later, a time signal, which was heard all over Europe, was broadcast from an Eiffel tower antenna. As television became popular, the "Tower" was the logical choice for their antennas.

As the huge sign on the side on the Tower counts down the days to the new millennium, the TV antennas still occupy a prominent place on the very top of the Eiffel Tower. But the rest of the Tower has taken on a whole new look. From the top glass enclosed observation deck, which will cost a visitor 59 francs (about 10 US dollars) to visit, ground plane antennas are visible mounted from each side. These appear to be in the 88 to 200 MHz range.

Walking up the short flight of stairs to the outside top deck allows the visitor great views of Paris; Sacre Coeur, Invalides, Louvre and of course, the winding Seine River. But looking up brings another amazing view; microwave dishes, helixes, ground planes, cellphone arrays and fiberglass enclosed verticals. The impressive wide variations of types is only eclipsed by their number. Every possible ledge and out-cropping hosts a VHF/UHF antenna. It seemed to me that the number has grown ten-fold in the past twenty years.

"What a scanner listener's paradise!" I



commented to my wife. She shot me a look of disbelief that I knew would cost me a shopping trip to the famous Paris department store, Galleries Lafayette.

### ■ Half Right!

I was right about the shopping at the Galleries Lafayette. But my "scanner's paradise" missed the mark badly. A good place to start investigating the monitoring scene in a country is their magazine stands. So, on the way to the shopping we stopped at a large magazine kiosk at the Metro (underground railway) station. "Electronique, radio magazines?" The resulting puzzled look worried me. Was it my French, or the lack of French monitoring magazines? Stops at five other newsstands proved the answer was "yes" to both questions. I was shown lots of French computer magazines and electronic project construction magazines from other European countries. But no French monitoring.

After my sixth stop produced the same results I changed my approach and asked for "CB rah-d-o." I was presented with a choice of four French CB radio publications. *FCB* (French CB) had the most amateur radio-like articles and ads. But no scanner frequencies

list. Looking at the ads I began to recall that France was one of the most expensive places to buy radio equipment in western Europe. A used FRG-8800 was still priced at over \$600 US!

I paid the 27 FF (about \$5.00 US) for the forty-seven pages and headed for a memorable feast at a small family-run Paris restaurant, Le Petit Troquet. At least the wonderfully prepared and presented French food was affordable...if you knew where to look.

### ■ Voilà - The Mystery Is Solved

The next day I spoke with Christian Netange, the manager of RCS, Radio Communications Systems, at 4 Boulevard Diderot in Paris. RCS carries ICOM, Kenwood, Alinco and many others. The first thing that struck me was the large variety of transceivers, antennas and accessories that RCS sells, both new and used. Their used gear is in pristine condition and usually carries a six month to one year guarantee. Lots of ham transceivers and shortwave receivers but not a scanner, or computer, in sight. When I asked Christian where the scanner department was he replied that I had to ask the government that question. The French government had almost banned unlicensed monitoring above 30 MHz a year ago.

With ICOM prominent at RCS I asked Christian about the new IC-PCR1000 and Rosetta Labs WinRadio 1000i. Until about six months ago both radios were available in France. But the government had gotten "very serious" about the ban and stopped the radios at the border. The week before the police had raided two dealers (just radio dealers!) who had the ICOM IC-PCR1000 for sale. They shut them down and charged them with violation of the law. Goodbye scanner paradise!

But what about French shortwave computer monitoring? Thanking Mr. Netange, I decided to investigate the French computer market.

### ■ Some More Digging

At a local newsstand away from the crowded boulevards, I bought a "rah-d-o" publication whose cover looked very famil-

iar. "Radioamateur," with its red colored "CQ," was unmistakably related to the American publishing group, CQ Communications. Although totally in French, most of the articles were written by US hams. It cost me another \$5.00 to discover that it was not quite the French radio scene I was trying to find.

After making some more inquiries I found a few radio computer programs written in French. Spirales Editions sells five radio related computer programs for the PC. Two are decoders: Fax (FAXI 1.0) and RTTY (RTITI 1.0) are available for 110 FF (\$20 US) each. A logging/QSL program (Carnet de TRAFIC 4.0) is priced at 130 FF (\$22 US). QRMI 1.0, priced at 110 FF, attempts to predict the potential sources of harmonics interference. Check out their website at <http://www.spiraweb.com>. It contains some interesting radio links; most in French only. But I could not find a French radio control and database program such as ScanCat or SWL Manager.

### ■ Parlez Vous Computer?

The French computer market has also changed dramatically in the last few years. In the eighties European computer products lagged the US introduction by many months. When they became available they were twice the US price. Now that has all changed. Today, Pentium 233 MMX systems are commonly available in France. Their price is not much more than 20% greater than in the US. So why so little radio related French software?

Before I get myself into trouble, the following explanation is the common hypothesis of three French people who I questioned separately. They suggest that two factors are at play. First, the majority of radio monitors are over forty years of age. They grew up during a period in France when "pollution of the French language with English (or any language) could result in a stiff fine. I remember a much publicized case in the nineteen eighties when a French magazine was fined for using the word "weekend." Therefore, this age group is not comfortable with the English language (Remember, this is their explanation). Although most commercial computer programs (Microsoft) are translated in French, French radio program applications are "next to impossible to come by."

### What about the Internet as a Source?

If you take a look at the website that I



mentioned for the French radio programs you will find a few links to French radio related websites. (An interesting aside is that *Megahertz* magazine is prominently listed in the link, but could not be found at any newsstand in Paris. Perhaps it's subscription only.) When I asked the locals why the internet was not considered a source I was told a another interesting story concerning Minitel.

### ■ Mini-Who?

Years before the average US citizen knew what a database was, or a modem, or terminal, the French were putting a free one in each household. In a bold and forward thinking move, the French telephone company came up with the idea of putting directory assistance, or information, on a database. Then they provided each telephone subscriber a small terminal that was connected to the phone line. Enter Minitel. A great idea in 1980. But according to the people I spoke with, it was embraced for too long. This resulted in the very slow acceptance of the Internet in France, especially among the forty-plus age group that grew up with Minitel.

Yes, it's changing slowly. However, the young people have replaced both Minitel and radio monitoring with the Internet. This sce-

nario came from three separate French sources. There must be some truth to it.

### ■ 7th Arrondissement - Land of Big HF Antennas

Paris is broken down in numbered zones, or *arrondissement*. The 7th is the location of both the Eiffel Tower and many of the foreign Embassies. In 1979 every embassy had a giant log periodic antenna on its roof. These antennas

have high gain over a wide frequency range and are a favorite with the world's military forces. These big ones were clearly used in the shortwave spectrum and provided us with hours of utility listening.

Things are a bit different in 1998. It seems that more than half of the big log periodics are now gone. But many embassies now have big dish antennas; and not for DSS! Even the remaining HF antennas are now accompanied by satellite communication antennas. The shortwave is probably used only as a backup communication circuit.

### ■ Paradise Lost

It would have been so good. I'm sure the Paris ether is just full of interesting scanner signals. But *c'est le guerre* ... that's the war. I fired up my pocket shortwave receiver. During the 1980s in Paris, it was almost unusable at night due to the number of European shortwave broadcast stations and US Armed Forces Radio. Now, in 1998, it was surprisingly quiet. "Boy, when paradise goes it really leaves town," I reflected out loud. Somehow I don't think my wife had the same thoughts sipping her cup of cappacino on the Seine across from Notre Dame cathedral. I guess paradise is a personal place.

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## "Sounds" Interesting...

"In Robert Wyman's interesting 'Safe Shoals' article (*MT*, Mar 1998) he stated that the nautical term 'soundings' originated with acoustic depth measurement systems. Actually that word was common when a weighted rope was used, long before anybody dreamed of electronic devices. My dictionary says it comes from a Latin root meaning 'submerged.'

"The article also interested me because it mentioned John E. Chance & Associates, whom we used to hire to position drilling rigs years ago before I retired from the offshore drilling business. Back then they used optical instruments with surveyors on other fixed platforms communicating by radio. Now I suspect they just send out one person with a DGPS (differential global positioning system) unit!"

— Irv Smith, KK5QQ, Missouri City, TX

## Who is Herb?

"If you are interested in a human interest story you might listen to 12359 MHz USB at 4pm (2000 UTC) daily. You will hear 'Herb's Net.' This fellow gives detailed weather information to dozens and dozens of vessels both in port and at sea in the Atlantic and further south. He does it free of charge and his knowledge about weather and the sea in general are outstanding. I don't know for sure but I guess he is a retired Master that now goes 'down to the sea in ships' via his radio and sharing his know how with the mariners of today."

Charlie Riecke emailed this to us as well as querying others on the internet. I referred him to Larry Van Horn's "Who is Herb?" Utility World column from October '96, but he also received the following reply from Don Radcliffe of the *S/V Klondike*:

"You've been listening to Herb Hilgenberg (ham call VE3LML, according to our search), who used to broadcast out of Bermuda, and now is in Canada. He answers to 'Southbound II,' but usually has a long list of boats wanting his advice. If you catch him on a slow day or are the only boat in your area, he's pretty good at responding to you as long as you are offshore (I've heard people in the ICW [intra-coastal waterway] use him, which is a terrible waste of resources, as they have continuous VHF weather available).

"Herb devotes an incredible amount of his time and energy to helping sailors from Europe to Panama (he used to do the South



Grove Enterprises received this maritime mobile QSL card from Raul Marcos do Sacramento, PYIAT, in Rio de Janeiro, Brazil, communicating by voice, code, and via the RS12 satellite.

Pacific, but now quits at the Galapagos and Tehautepec). His advice tends to be conservative (one boat last year waited 28 days for him to recommend a passage from the ABC's [Aruba, Bonaire, and Curacao] to Panama), but accurate (they didn't get damaged like a number of boats who didn't wait). The only problem is that people are getting too dependent on him, and one of these years he'll burn out from his two hours a day, seven day a week schedule, like Arnold in Rarotonga and John in Kerikeri. I hear that he accepts donations, but he doesn't ask for them; it would sure be nice to give him some official recognition for his efforts."

## The New Look of VOR

The sketch in last month's look at VOR (VHF omnidirectional range) facilities didn't do justice to the physical appearance of this small building commonly seen at the airport.



The accompanying photograph (photographer unknown) shows the typical facility, with the addition of TACAN (tactical air navigation system) — the vertical extension on top of the cone.

The second photo is an example of a new VOR design. We believe this one was shot in Florida by Robert Wyman.



## More Catholic than the Pope?

Annette Savoy called us from Florida in response to Glenn Hauser's lead item in April. Radio hobbyists usually like to hear a variety of points of view before making up their minds. Ms. Savoy encourages those readers who want to know more about the issues being disputed on WEWN to get the Catholic publication *The Wanderer*. You can call for it at 612-224-5733 or write 201 Ohio St, St. Paul, MN 55107.

## Give a Kid a Radio Education

"I am happy to tell you I have just paid for a six month subscription of *MT* for a middle school. When I was in junior high school, I had a big interest in the radio hobby. Unfortunately, I could not find any good books or magazines on this topic. This is the reason why I am paying for their subscription. I hope the kids at Eagle Peak Middle School will learn something from *MT* — of course they will! *MT* is not only fun, but it's also an education."

— Peter Egypt, Redwood Valley, CA

Thanks, Peter, great idea! While we'll give a complimentary subscription to a teacher who uses radio in the classroom, donating *MT* to the school library is a good way to make *MT* available to the general school population. Or how about donating a subscription to your local public library?

## Thanks, Bob Grove

"I can't thank you enough for the response to my e-mail. I was, frankly skeptical as to whether I would get a response since my question seemed like such a dumb beginner's question. I thought you might not find it worth replying to. I was WRONG! That just confirms the impression I have gotten from just my first two issues of *Monitoring Times* — It's a quality magazine staffed and operated by great people."

— Jeff Hawkins, via email

We're happy to help, Jeff, when we can. If we can't, we'll forward the question to one of our columnists. If your question is via email, it simplifies the process, but if you send a written query, remember to enclose a self-addressed, stamped envelope. Our columnists—except for Bob Grove and Larry Van Horn—do not reside in Brasstown, so all mail has to be forwarded. Please allow time for a reply!

I hope you enjoyed our maritime issue: stay tuned next month as we discuss emergency, public service, and disaster monitoring!

— Rachel Baughn, [rachel@grove.net](mailto:rachel@grove.net)

# GLOSSARY OF TERMS USED IN MT

AC	Alternating Current
ACARS	Aircraft Communications Addressing and Reporting System
AFB	Air Force Base
AM	Amplitude Modulation
AMSAT	Radio Amateur Satellite, Inc.
ARQ	Synchronous transmission and automatic repetition teleprinter system
ARQ-E3	Single channel ARQ teleprinter system
ARQ6-90	Six-character blocks simplex ARQ teleprinter system
ARRL	American Radio Relay League
ASCII	American Standard Code for Information Interchange
Assoc	Association
ATC	Air Traffic Control
Autodin	Automatic Digital Network
CB	Citizen Band Radio
CD	Compact Disc
CD-ROM	Compact Disc Read Only Memory
CG	Coast Guard
CI-V	Radio computer interface made by Icom
Comm	Communications
CO	Commanding Officer
CP	Command Post
CQ	General Call to all stations
CTCSS	Continuous Tone Controlled Squelch System
CW	Continuous Wave (Morse code)
dB	Decibel
DC	Direct Current
DCS	Digital Coded Squelch
de	Morse code prosign meaning "from"
DEA	Drug Enforcement Administration
DSS	Digital Satellite System
DTMF	Dual Tone Multi Frequency
DX	Distant radio or television signals
DXing	The hobby of listening to distant radio or television signals
ELT	Emergency Locator Transmitter
FAX	Facsimile
FCC	Federal Communications Commission
FEC	Forward error correction teleprinter system
FEC-A	One-way traffic FEC teleprinter system
FFH	Fast Frigate Helicopter
FM	Frequency Modulation
FTP	File Transfer Protocol

GHz	Gigahertz (1,000,000,000 hertz)
GPS	Global Positioning Satellites
HM	Her Majesty
HMCS	Her Majesty Canadian Ship
hp	Horsepower
hrs	Hours
Hz	Hertz
ID	Identification
Intl	International
ISA	Industry Standard Architecture
IPX	Internetwork Packet Exchange
IRC	International Reply Coupon
ITU	International Telecommunications Union
kbps	Kilobytes per second
kHz	Kilohertz (1,000 hertz)
kW	Kilowatt (1,000 watts)
LCD	Liquid Crystal Display
LED	Light Emitting Diode
mA	milliamperes
Mbps	Megabytes per second
MHz	Megahertz (1,000,000 hertz)
mm	Millimeter
M/S	Merchant Ship
MV	Motor Vessel
MW	Megawatts (1,000,000 watts)
MW	Medium Wave (typically 530-1710 kHz broadcast band)
NetBEUI	NetBIOS Extended User Interface
NetBIOS	Network Basic Input/Output System
NIC	Network Interface Card
NiCd	Nickel Cadmium
NRC	National Radio Club
PC	Personal Computer
PCI	Peripheral Component Interconnect
PBS	Public Broadcasting System
PLL	Phase Locked Loop
POL-ARQ	Polish diplomatic ARQ teleprinter system
QRM	Interference
QRP	Low power operation
QSL	A card or letter confirming reception of a radio station
QSO	Communications between two or more stations
RAF	Royal Air Force
RCS	Radio Communication System
RF	Radio Frequency
RMS	Royal Majesty Ship
RN	Royal Navy
rpm	Rotations per minute
RTTY	Radioteletype

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SINPO	A code system used by radio hobbyists to indicate how well a station was received S=Strength, I=Interference, N=Noise, P=Propagation, O=Overall	TACAN	Tactical Air Navigation	WVW	National Bureau of Standards
SIO	A code system used by radio hobbyists to indicate how well a station was received S=Strength, I=Interference, O=Overall	TCP/IP	Transmission Control Protocol/Internet Protocol	Wx	Time Station, Ft. Collins, CO
SITOR-A	Simplex teleprinting over radio system, mode A	TV	Television	73	Weather
SPX	Sequenced Packet Exchange	Twinplex	Four-frequency duplex teleprinter system	//	Best Regards
SSN	Sunspot Number	Unid	Unidentified	3	Indicates a Parallel Frequency
STRATCOM	Strategic Command	URL	Universal Resource Locator	s	Ohm
SW	Shortwave (high frequency - HF)	US	United States		microsecond
SWL	Shortwave Listener	USA	United States of America		
		USB	Upper Sideband		
		USAF	U.S. Air Force		
		USCG	U.S. Coast Guard		
		USS	United States Ship		
		UTC	Universal Time Coordinated		
		VAC	Volts Alternating Current		
		VDC	Volts Direct Current		
		VF	Voice Frequencies (3-30 kHz)		
		WLM	Coastal Buoy Tender (Medium Endurance) gUS Coast Guard cutter		

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UHF	Ultra High Frequency (300 MHz-3 GHz)
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By Bob Grove,  
Publisher

## Bits and Pieces

It's always a relief to have a month in which nothing catastrophic has happened in the radio world so that I can address much more interesting—and sometimes entertaining—issues. This is such a month, and the first item is such an issue:

### ■ Gone Squirrely

I had noticed for quite some time the gradual reduction in signal strengths from my VHF/UHF beam. Nothing dramatic at first, but recently the signal degradation had become very noticeable.

A glance at the antenna showed it to be just fine, and a distant examination of the coax revealed nothing suspicious. A test of the lightning arrestors showed them to be fine, and a test of the coax from the junction box at the house to the receiver showed nothing unusual. But then I put the ohmmeter across the coax up to the antenna and discovered quite a resistance, when it should have indicated a short circuit from a trap coil.

Running my hand along the coax, I discovered the problem: some demented squirrel had eaten it! An expedient replacement of the chewed section restored full signal strength once again.

### ■ This Model's a Mongrel

A recent ad received from a major CB distributor contained a surprise. We all know that hams aren't supposed to operate in the citizens band, but this ad featured a ten-meter amateur rig with a "roger beep" and an echo box! I can hardly wait to put *that* sucker on the ham bands! And I'll bet there's an easy-to-find jumper which will restore full CB coverage as well!

### ■ Sympathy for the FCC

If it's possible to feel sorry for a federal agency, I really do feel sorry for the Federal Communications Commission. In spite of the squabbles our radio interests have endured regarding the cellular-capable scanner issue, that issue was brought about by the cellular industry's influence on Congress, not the FCC. My relations with the Commission have always been amicable.

As the FCC's budget continues to shrink, and their manpower shrinks with it, their work load has not decreased. It's getting bigger. Managing auctions of the spectrum was not an original purview of the Commission, and new-technology issues like digital audio and TV, and satellite-borne Personal Communications Services (PCS), have further confounded the picture.

Abandonment by the Commission of many traditional responsibilities such as telephone company deregulation, broadcast deregulation (Telecommunications Act of 1996) which stimulated magnate buyouts and mergers in the broadcast industry, and elimination of type approval of new equipment—with serious talk as well about deleting type acceptance and notification—have led many knowledgeable observers to speculate that the days of the FCC are numbered. There are members of Congress who would like to see this happen, reassigning the Commission's former responsibilities to the Department of Commerce.

### ■ It's Elective

And finally, I received an interesting letter from a reader who wanted to know why hobby radio antennas do not meet the criteria of the National Electrical Code. "Article 810," he pointed out, "covers antennas for both receiving and transmitting equipment, and NEC Article 250...covers grounding for amateur equipment."

For transmitting, wire antennas greater than 150 feet in length shall be no smaller than 10 gauge (12 gauge for receiving—don't ask me why), and must not cross above or come within several feet of power lines (that part makes sense).

I called the legal department of the National Fire Protection Association, who publishes the NEC, for their comment. Since the NFPA is a private organization, the NEC is simply a set of recommended guidelines. If a state or local jurisdiction chooses to adopt it, compliance may be enforced at the discretion of the officials. Compliance outside of such a jurisdiction is voluntary.

So there you have some of the interesting issues that cross my mind or my desk. Until next month—happy sailing!

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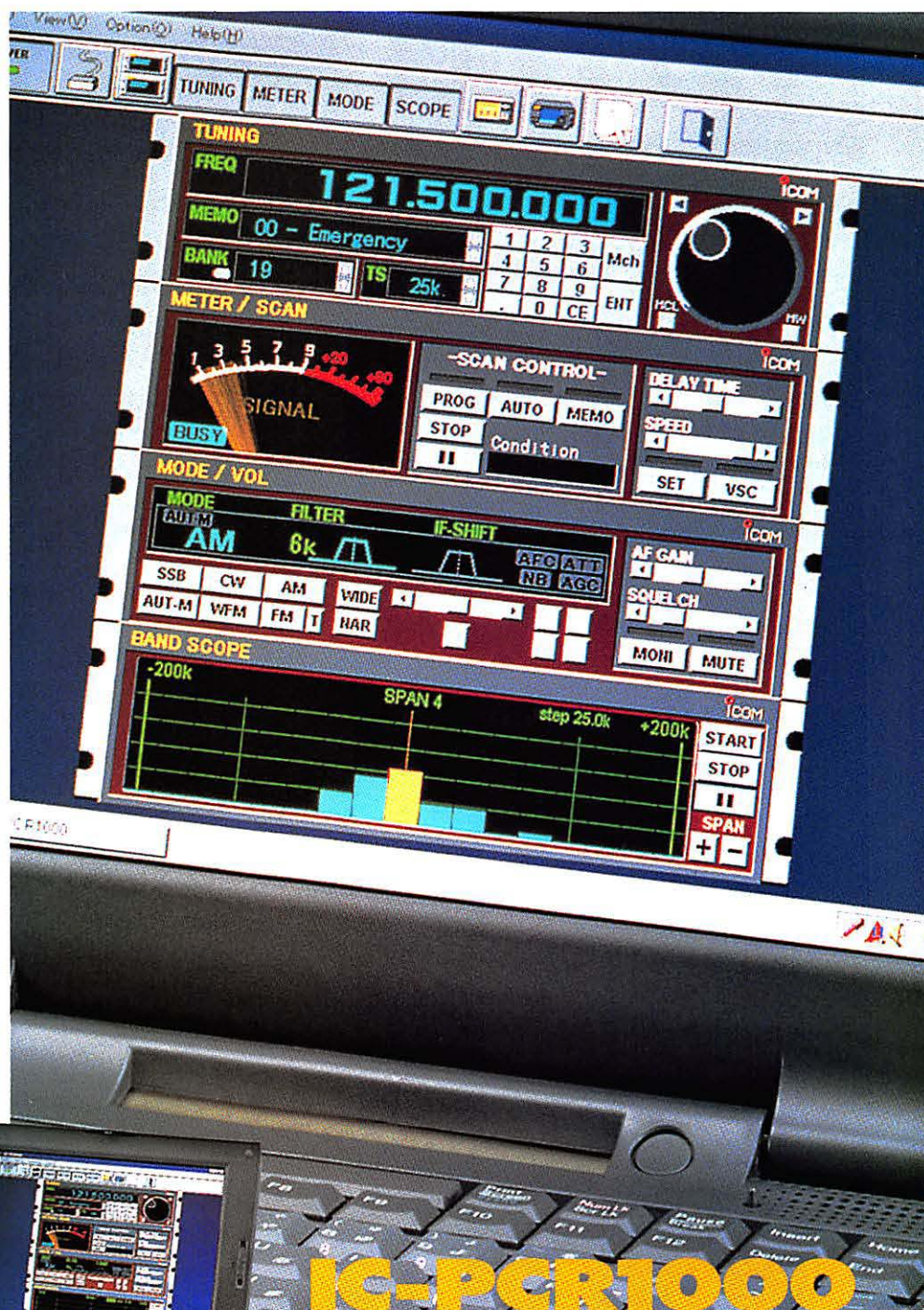
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